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Sent: Friday, March 14, 2014 2:54 PM
To: Rochlin, Kevin
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Subject: RE: Comments on the Data Gap Report
Attachments: 2014-03-14 FMC Responses to EPA Comments on the Data Gap Report for thepdf; 2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf

Categories: Lepic 3-22 to 4-4, COPIED TO LEPIC FOLDER ALREADY

Kevin,

Please find attached FMC's responses to the EPA comments on the Data Gap Report for the FMC OU received from EPA on February 20, 2014 as well as a revised copy of the Data Gap Report with the changes shown highlighted in yellow. Revised Figures 2-2 and 4-1 and minor pagination changes are not highlighted.

Any questions, please advise.

From: Rochlin, Kevin [<mailto:rochlin.kevin@epa.gov>]
Sent: Monday, March 03, 2014 11:17 AM
To: Barbara Ritchie
Subject: RE: Comments on the Data Gap Report

Your request for an extension is approved.

Kevin

From:

Kevin Rochlin | Superfund Remedial Project Manager
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From: Barbara Ritchie [<mailto:BARBARA.RITCHIE@fmc.com>]
Sent: Thursday, February 27, 2014 7:40 AM
To: Rochlin, Kevin
Subject: RE: Comments on the Data Gap Report

Kevin,

As per my voice message, the UAO would appear to require us to respond to the comments you provided on the Data Gap Report within 15 days, which would be 3/5/14. FMC requests your approval of an extension until 3/14/14 to submit a response to these comments and a revised Data Gap Report.

Please confirm your approval.

From: Rochlin, Kevin [<mailto:rochlin.kevin@epa.gov>]
Sent: Thursday, February 20, 2014 12:49 PM
To: Barbara Ritchie
Cc: Douglas.Tanner@deq.idaho.gov; Greutert, Ed [USA]; Kelly Wright; Scott Miller - Idaho DEQ (Scott.Miller@deq.idaho.gov); Stifelman, Marc; susanh@ida.net; Zavala, Bernie
Subject: Comments on the Data Gap Report

See attached file.

Kevin Rochlin

From:

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FMC Idaho LLC, Pocatello, Idaho

**REMEDIAL DESIGN
DATA GAP REPORT
for the FMC OU**

March 2014

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ACRONYMS/ABBREVIATIONS

ASTM	American Society of Testing and Materials
bgs	below ground surface
CERCLA cm/sec	Comprehensive Environmental Response, Compensation, and Liability Act centimeters per second
DGWP	Data Gap Work Plan
EPA ET	U.S. Environmental Protection Agency evapotranspirative
ft	feet
in. IRODA	inch Interim Record of Decision Amendment
LL	liquid limit
meq MDD mg/kg mmhos	molar equivalent maximum dry density milligrams per kilogram micromohs
OMC OU	optimal moisture content operable unit
lbs/ft ³	pounds per cubic foot
PI PL	plasticity index plastic limit
RA RAO RDRA RDWP	remediation area remedial action objective Remedial Design/Remedial Action Remedial Design Work Plan
SB SFS SRI	soil boring Supplemental Feasibility Study Supplemental Remedial Investigation
TCLP TP	Toxicity Characteristic Leaching Procedure test pit
UAO	Unilateral Administrative Order
WUA	Western Undeveloped Area

1.0 INTRODUCTION

As specified in the *Interim Amendment to the Record of Decision for the EMF Superfund Site FMC Operable Unit* (IRODA; EPA 2012), the selected soil remedy for the FMC OU includes the construction of soil covers over specified remediation areas (RAs). Two soil cover designs are specified: gamma cap and evapotranspiration (ET) cap. The preliminary designs for these soil covers are summarized below:

- The ET soil cover design consists of a minimum cover thickness of 24 inches of soil that will provide sufficient water storage and an additional 6 inches of soil to address potential long-term erosion of the cover. The design basis is presented in the *Comparison of Conventional and Alternative Capping Systems for Use at the FMC Plant OU (Capping Memorandum)* contained in Appendix D of the *Supplemental Feasibility Study Report for the FMC Plant Operable Unit (SFS Report, MWH, 2010)*.
- The gamma soil cover consists of a nominal 12 inches soil and is expected to provide sufficient gamma shielding from underlying fill materials. As described in the Remedial Design Work Plan (RDWP; MWH, 2013a), a gamma cap performance evaluation will be detailed in the separately-submitted Gamma Cap Performance Evaluation Work Plan.

The selected remedy requires approximately 155 acres of ET soil covers and 340 acres of gamma soil covers. The soil to be used for construction of both types of covers will be removed from the Western Undeveloped Area (WUA), an area of the westernmost portion of the FMC Plant OU that was never used in the phosphorus manufacturing process. Additional site-specific soil data from the WUA is required to proceed with cover design. This report details the additional soil sampling and material (geotechnical) testing that was performed to better define the volume of available borrow soil and its material properties to finalize the design of the soil covers.

As specified in the IROD, the selected groundwater remedy for the FMC OU includes groundwater extraction and treatment, with treatment either at the City of Pocatello POTW or by a water treatment facility built within the FMC OU. The latter alternative would discharge treated water to an infiltration basin, from which it would either percolate down to groundwater or evaporate to the atmosphere. FMC is evaluating both of these treatment options. This report describes the collection of soil percolation data that was performed to support the evaluation and potential design of the onsite percolation/ evaporation basin(s).

Another remedial action requirement of the IROD is that elemental phosphorus residues that may remain in underground 16-inch, reinforced concrete storm/sewer piping in RA-A must be removed and disposed of offsite. This report presents the procedures used to perform a video survey of that underground storm drain piping to better understand the volume of residual solids it contains and support design of this element of the remedial action.

1.1 REGULATORY BACKGROUND

On June 10, 2013, EPA Region 10 issued a Unilateral Administrative Order to FMC for Remedial Design and Remedial Action (UAO for RD/RA, or UAO; EPA 2013), EPA Docket No. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-10-2013-0116. The UAO for RD/RA requires FMC to implement the interim remedial actions that EPA selected in its September 27, 2012 Interim Record of Decision Amendment for the FMC OU (“IRODA”). FMC is implementing the selected remedy in accordance with the UAO.

As summarized in Section 3 of the RDWP a data gap investigation was performed between October 29th to November 13th, 2013 to collect site specific data to support the RD as defined in of Section IX, Paragraph 30 a. and 30 b. of the UAO. This Data Gap Report summarizes the investigations performed and testing completed in accordance with the Data Gap Work Plan (DGWP; MWH, 2013b) that was approved by EPA on **October 22, 2013**.

1.2 FMC SITE DESCRIPTION

A description of the FMC OU is presented in Section 2 of the RDWP. A site map showing the FMC OU RAs and WUA is provided on Figure 1-1.

1.3 PURPOSE AND SCOPE OF REPORT

This report has been developed to provide the following:

1. Summarize the site investigations and material testing performed as per the DGWP;
2. Present the results of soil testing performed on samples collected from the WUA, including properties (geotechnical, hydrological, agronomical, vegetative) to support design of the ET soil covers and evaluate potential design of the infiltration basin option for managing treated groundwater;
3. Provide an estimate of the availability of borrow soil within the WUA for cap construction;
4. Present the results of the RA-A stormwater sewer survey; and
5. Provide an estimate of the root density expected based on the vegetation trial plot survey.

1.4 DOCUMENT ORGANIZATION

The remainder of this **Data Gap Report** consists of the following:

- Section 2.0 Data Gap Field Investigations – Presents a summary of the field investigations performed per the DGWP.
- Section 3.0 Laboratory Testing – Presents a summary of the laboratory testing performed on samples collected during the field investigation.

-
- Section 4.0 Data Gap Investigation Results – Presents the results of the field investigation, including a summary of soil property testing, root density testing, and the stormwater sewer video survey.
 - Section 5.0 contains references.
 - Appendix A: Field Investigation Photographs
 - Appendix B: Test Pit Logs
 - Appendix C: Soil Boring Logs
 - Appendix D: Geotechnical and Hydrological Testing Reports
 - Appendix E Agronomic Testing Reports
 - Appendix F: Root Density Testing Reports
 - Appendix G: RA-A Stormwater Sewer Decontamination Waste Determination Laboratory Reports and DVD of Video Survey
 - Appendix H: ProUCL 5.0 Statistical Analysis

2.0 DATA GAP FIELD INVESTIGATIONS

A variety of field investigations were performed during October 29th to November 13th per the DGWP and included the following:

- Excavation of 10 test pits within the WUA;
- Drilling of 5 soil borings within the WUA;
- Video survey of stormwater sewer piping in RA-A; and
- Collection of soil samples from the FMC vegetation trial plot.

A description of the above investigations is provided below. Photographs taken during the field investigations are presented in Appendix A.

2.1 WESTERN UNDEVELOPED AREA INVESTIGATIONS

A focused investigation was performed in the WUA consisting of test pits and soil borings. Test pit and soil boring locations are presented in Figure 2-1 and a summary of the investigations are presented in Table 2-1. Test pit and soil boring logs from the WUA are presented in Appendix B and C, respectively.

Table 2-1 Summary of WUA Soil Investigation

Test Pit/Soil Boring I.D.	Total Depth (feet bgs)	Depth of Gravel (feet bgs)	Maximum Depth of Grab Sample	Sample Depths/Intervals
TP001	15.7	15.7	10	Grab samples collected at 1 foot intervals down to 10 feet.
TP002	17.3	NC ^{a/}	10	Grab samples collected at 1 foot intervals down to 10 feet.
TP003	4	4	3	Grab samples collected at 1 foot intervals down to 10 feet.
SB003	31.5	2.0	15	Undisturbed sample collected at 0 to 2 feet (bgs), and disturbed sample collected 2 to 15 feet.
TP004	18	NC ^{a/}	10	Grab samples collected at 1 foot intervals down to 10 feet.
SB004	31.5	23.5	NA	Undisturbed samples collected at 2 to 4 and 6 to 8 feet (bgs).

Test Pit/Soil Boring I.D.	Total Depth (feet bgs)	Depth of Gravel (feet bgs)	Maximum Depth of Grab Sample	Sample Depths/Intervals
TP005	20.5	NC ^{a/}	11	Grab samples collected at 1 foot intervals down to 10 feet.
TP006	17.1	NC ^{a/}	10	Grab samples collected at 1 foot intervals down to 10 feet.
SB006	31.5	21.1	NA	Undisturbed samples collected at 2 to 4, 6 to 8 feet (bgs).
TP007	19.8	NC ^{a/}	10	Grab samples collected at 1 foot intervals down to 10 feet.
SB007	31.5	24.5	NA	Undisturbed samples collected at 2 to 4, 6 to 8, and 12 to 14 feet (bgs).
TP008	19.8	NC ^{a/}	10	Grab samples collected at 1 foot intervals down to 10 feet.
SB008	31.5	30.0	NA	Undisturbed samples collected at 2 to 4 and 6 to 8 feet (bgs).
TP009	12.3	7.5	7	Grab samples collected at 1 foot intervals down to 10 feet.
TP010	9.0	6.0	6	Grab samples collected at 1 foot intervals down to 10 feet.

Notes:

^{a/} NC = gravels not contacted in test pit before maximum depth of the excavator was reached.

2.1.1 Test Pits

A total of ten (10) test pits (TP001 through TP010) were excavated throughout the WUA. Grab soil samples were collected from each test pit at approximately 1-foot intervals down to 10 feet or until gravels were contacted and composited to provide 2 5-gallon buckets of representative soils from each location per the Work Plan. The test pits were excavated to various depths ranging from 7 to 20 feet below ground surface. Soils encountered in the test pits were predominantly loess silt (silt) overlying gravels. The depth of silts ranged from 4 to 20.5 feet deep with the majority of test pits encountering silt down to at least 15 feet. Depth measurements were completed at the base of the test pit and in any test pits where gravels were contacted. As indicated by the test pitting and confirmed by the subsequent soil borings, shallow

gravel was contacted in TP003, TP009, and TP010 at depths ranging between 4 and 7 feet bgs. This gravel deposition appears to bisect the WUA in an east-west direction, generally shallower on the east end and deeper on the west end. Additional exploratory borings were also excavated, without samples being collected on the north and south sides of TP003, TP009, and TP010 to define the lateral extent of the gravel lense. Visual observations during the exploratory borings indicate that there is a sharp drop in depth of the gravels at an approximate distance of 300 feet on either side of the test pits where gravel was contacted. The field investigation (including test pits and soil borings) adequately characterized the extent of the shallow gravels for assessing the amount of soil available for use as capping soil in the WUA.

2.1.2 Soil Borings

Five soil borings (SB003, SB004, SB006, SB007, and SB008) were collocated within 20 feet of five test pit locations (TP003, TP004, TP006, TP007, and TP008) and drilled to depths ranging up to 31.5 feet. The purpose of the soil borings were to collect undisturbed samples of the silt, to characterize the general depth of gravels underlying the silts, and collect disturbed samples of the gravel. Undisturbed samples of the silts were collected at SB003, SB004, SB006, SB007, and SB008 using a Shelby tube at depths of 0 to 2-feet, 2 to 4-feet and 6 to 8-feet with one sample collected at 12-14 feet. The undisturbed silt sample was collected at 0 to 2-feet at SB003, but no deeper samples were collected, due to the presence of gravels at 2 feet and below. The sample at 12-14 feet was collected at SB007 to provide additional information related to the in-situ hydraulic conductivity of the silts at deeper depths. One grab sample of the gravels recovered from the auger during drilling from 2 to 15 feet bgs in SB003 was also collected for laboratory permeability analysis. Based on visual observation, the underlying gravels size was predominantly 3-inch minus and were metamorphic in nature.

The DGWP specified that gravel samples would be collected at a depth approximately 10 feet below the gravel horizon in each soil boring. When the Data Gap Work Plan (MWH, 2013) was prepared, the depths of gravels were believed to be shallower, on the order of ± 10 feet. However, during the test pitting, the depths of gravel were shown to be generally much deeper than 10 feet throughout the site, with the exception of the east-west trending shallow gravel area. The main purpose of the gravel sampling was to determine the hydraulic conductivity of the gravels for the purpose of sizing potential infiltration basins for treated groundwater. Given that the depth of excavation required to obtain the required amount of capping soil in general will be much shallower than the underlying gravels, it was determined that the controlling factor in the infiltration basins will be the in-situ hydraulic conductivity of the silts. Therefore, an undisturbed sample of the silts was collected at a deeper depth, 12-14 feet bgs, in SB0007 to provide data for this purpose. Further, the gravels that were contacted appeared to be very uniform in terms of shape and size suggesting that the hydraulic conductivity of these gravels will be fairly uniform. Therefore, no additional sampling is required at deeper depths for the gravels.

2.2 STORMWATER SEWER SURVEY

2.2.1 Background and Objectives

Historical information gathered during the Supplemental Remedial Investigation (SRI) indicated that the subsurface stormwater piping located in RA-A had carried stormwater runoff and process materials from the furnace building and phos loading dock (RA-B) to the railroad swale (RA-K). These process materials consisted of wash waters that were suspected of containing ore, slag, precipitator slurry, and phossy water (containing elemental phosphorus). However, it was not known if these materials were still present in the underground stormwater piping and to what extent. The selected remedy (Soil Alternative 3) prescribed that the underground stormwater sewer piping within RA-A (to be capped with a gamma cap) be cleaned out to remove any process materials that could present a threat to groundwater or future site workers (i.e., elemental phosphorus, metals, and radionuclides). **Underground storm sewer piping that is successfully cleaned in-place will no longer present a threat to human health and the environment as all COCs potentially associated with the storm sewer piping (i.e., P4, radionuclides, metals, and leachable metals posing a threat to groundwater) will have been removed and appropriately disposed. Therefore, cleaned underground storm sewer piping by itself meets all of the RAOs specified in the IRODA.**

A video survey of the subsurface stormwater piping located in RA-A was conducted to determine the approximate volume of accumulated solids within the piping (with the potential presence of P4) and to estimate the amount of material (sediments) that will require removal, characterization, and disposal. The subsurface stormwater sewer piping included in the video survey is presented in Figure 2-2. Although the cleaning of the stormwater sewer piping as specified in the selected remedy was limited to the piping within RA-A, an attempt will be made to clean all of the stormwater sewer piping as shown in Figure 2-2 during the remedial action. If cleaning of any piping segment is not possible due to physical constraints, the ET cap over RA-B will be extended to cover the uncleaned segments. **As stated in the IRODA, placement of a properly designed ET cap over underground piping would meet all of the above listed RAOs, even with the presumption that radionuclides, metals, and/or P4 remain within the un-cleaned sections of the underground storm sewer piping.** Also, any stormwater piping which extends under an ET cap will be plugged with concrete to prevent water migration through the piping under the ET cap.

2.2.2 Video Survey Description

The stormwater sewer video survey was performed on November 6, 2013. The video surveillance utilized a remote control robotic camera that was lowered down into the piping through existing drain inlets, manholes and discharges. This technology is typically used on underground sewer piping that has been cleaned prior to the survey. Results of the video survey were very useful, but limited due to the inability of the robotic camera to proceed through 16-

inch piping that was partially full of sediment and did not fit in the 8-inch lines. A DVD of the survey video is included in Appendix G. A summary of the video surveys is presented below with the surveyed piping segments shown on Figure 2-2:

- **The piping segment from west discharge pipe toward Area Inlet #4** - This piping segment consists of a 16-inch concrete pipe from the west discharge into the railroad swale (RA-K) toward the Area Inlet #4 (about 129 feet total length). This segment was about 50% full of sediments at the discharge and there was not sufficient headspace to send the robotic camera into this piping. The sediment as observed from the end of the west discharge pipe appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment.
- **The piping segment from Area Inlet #4 toward the west discharge pipe** – This piping segment is the same as described above. An attempt was made to send the robotic camera in the reverse direction from Area Inlet #4 toward the west discharge pipe. The robotic camera was only able to travel about 2 feet before becoming stuck in the sediment. The sediment as observed from the robotic camera and from decon of the robotic camera appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment. This pipe as observed from Area Inlet #4 was greater than 50% full of sediments.
- **The piping segment from east discharge pipe toward Area Inlet #1** - This piping segment consists of a 16-inch concrete pipe from the east discharge into the railroad swale (RA-K) toward the Area Inlet #1 (about 85 feet total length). This segment was surveyed with the robotic camera. The first half of the pipe was relatively clean from the east discharge until about 40 feet into the pipe. The pipe was about 10 to 20% full of sediment the remainder of the distance to Area Inlet #1. The sediment as observed from the robotic camera and from decon of the camera appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment.
- **The piping segment from Area Inlet #4 to Area Inlet #3** - This piping segment consists of a 16-inch concrete pipe from the Area Inlet #4 to Area Inlet #3 (about 107 feet total length). An attempt was made to send the robotic camera from Area Inlet #4 toward Area Inlet #3. The robotic camera was not able to travel down this segment due to the sediment. The sediment as observed from the robotic camera and from the decontamination of the robotic camera appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment. This pipe as observed from Area Inlet #4 is assumed to be 100% full of sediments.
- **The piping segment from Area Inlet #4 to Area Inlet #2 and Area Inlet #5** - These piping segments consists of 8-inch steel piping from the Area Inlet #4 to Area Inlet #2 (about 170 feet total length). A separate 8-inch steel pipe branches off from this segment toward Area Inlet #5 (about 180 feet total length). As the robotic camera could not pass through an 8-inch pipe, an attempt was made to send a cable camera from Area Inlet #4 toward Area Inlet #2 and Area Inlet #5. The cable camera was not able to travel down these piping segments due to the sediments in the pipes and access restrictions. The sediment as observed from the cable camera and from decon of the cable camera appeared to consist of ore, slag, rust, and native soils. There was no evidence of P4 in the

sediment. These pipes as observed from Area Inlet #4 are assumed to be 70% full of sediments.

- **The piping segment from Manhole #1 to Area Inlet #3** - This piping segment consists of a 16-inch concrete pipe from Manhole #1 to Area Inlet #3 (about 169 feet total length). The robotic camera was sent from Manhole #1 toward Area Inlet #3 and traveled about 55 feet before being blocked by sediment. The sediment as observed from the robotic camera and from decon of the robotic camera appeared to consist of ore, slag, and native soils. There was no evidence of P4 in the sediment. This pipe as observed from Manhole #1 is assumed to be 50% full of sediments.
- **The piping segment from Area Inlet #1 to Area Inlet #3** – While historical plant drawings indicate that the piping segment from Area Inlet #1 to Area Inlet #3 exists, visual investigation of the vault at Area Inlet #1 did not reveal the presence of a pipe entering from the south – only a pipe running towards the north to the East Discharge. Similarly, visual investigation of the vault at Area Inlet #3 only revealed pipes connected on the south side (from Manhole #1) and west side (toward Area Inlet #4); no pipe leaving to the north towards Area Inlet #1 was present. Whether the historical drawing was incorrect or had not been updated to reflect later removal of the pipe segment cannot be determined; regardless, there is no observable evidence that a segment of piping is present between Area Inlet #3 and Area Inlet #1. Therefore, this segment was not present to survey.

2.2.3 Equipment Decon and Waste Determination

After each segment was surveyed (or attempted to be surveyed), the robotic camera or cable camera were decontaminated as removed from the piping. The cameras and cables were decontaminated using water and brushes to mechanically remove the contaminants. The decon water was collected in a plastic drum. The removed materials appeared to be primarily ore, slag, and native solids. There was no evidence of P4 (i.e., no observed smoking). The decon water and sediments were separated and sent to a laboratory for waste determination analysis. The results of the analyses are presented in Appendix G. Based upon observations, process knowledge, and the laboratory analyses, the decon water and sediments removed from the video equipment were determined to be non-hazardous and were managed pursuant to the Work Plan.

Findings and conclusions of the video survey are presented in Section 4.4.

2.3 VEGETATION TRIAL PLOT SAMPLING

In order to provide site-specific information associated with root depth and density, sampling was performed on FMC's former vegetation trial plots to provide an estimate of these parameters for use in performance modeling of the ET cover. Prior to laying out the sampling grid, test holes were excavated with a shovel to identify an area containing at least 18-inches of soil. Once identified, a 25 ft by 25 ft transect was measured. The transect was further divided into 5 ft by ft sampling grids. Three randomly placed hand-auger borings were advanced within each sampling grid and samples were collected at 6-inch increments (e.g. 0-6'', 6-12'', etc.). In general, top

soil sampling was possible to a depth of 18-inches in the majority of soils with some locations only having top soil depth to 12-inches before contacting the underlying slag. The vegetation sampling grid is shown in Figure 2-3.

3.0 Laboratory Testing and Results

Following sample collection, the soil samples from the WUA, vegetation trial plot samples, and stormwater sewer piping were sent off for laboratory testing and analysis as described below.

3.1 WESTERN UNDEVELOPED AREA SOIL TESTING

3.1.1 Geotechnical Testing

Following collection of the disturbed (composite) and undisturbed samples, the samples were sent to IGES out of Salt Lake City for geotechnical and hydrological testing. The following tests were performed to further define the geotechnical properties of the soil:

Disturbed (composite) samples from test pits:

- Atterberg Limits (American Society of Test and Materials [ASTM] D4318) testing was conducted to evaluate the shrink-swell potential of the soil and its propensity to develop desiccation cracks during cyclical wetting and drying.
- Standard Proctor (ASTM D698) testing was conducted to further refine the maximum dry density (MDD) and optimum moisture content (OMC) of the soil to be used for specifying the percent compaction and in-place density of the soil.
- Particle size distribution testing (ASTM D422) was conducted to provide an indicator of material properties across the entire borrow area.
- Crumb and double hydrometer dispersion testing (ASTM D6572-12 and ASTM D4221-11) were conducted to evaluate the erosive potential of the soil due to dispersion.

Undisturbed samples from borings:

- In-situ density (ASTM D7263-09)
- In-situ moisture content (ASTM D2216-10)

The geotechnical tests and associated results performed on the grab samples collected from each test pit are summarized in Table 3.1. The laboratory report for the geotechnical tests are presented in Appendix D.

3.1.2 Hydrological Testing

The following tests were performed to determine the saturated and unsaturated hydrological properties of the borrow soil based on test pit samples and two boring samples (SB007 at 6' to 8' and 12' to 14' bgs):

- Saturated Hydraulic Conductivity (ASTM D5084)
- Water Characteristic Curve Testing (ASTM D6836)

The hydrological tests performed on the grab samples collected from each test pit and associated results are summarized in Table 3.2. The laboratory reports for the **hydraulic tests** are presented in Appendix D.

Table 3.1 Summary of WUA Soil Geotechnical Testing and Associated Results

Soil Test	TP001	TP002	TP003	TP004	TP005	TP006	TP007	TP008	TP009	TP010	SB003	SB004	SB006	SB007	SB008
Standard Proctor Compaction Test (MDD lbs/ft ³) (ASTM ^{a/} D698)	106.9	97.7	107	106.4	107.2	104.4	104.2	99.6	103.7	104.8	NA ^{b/}	NA	NA	NA	NA
Optimum Moisture Content (OMC %) (ASTM D698)	17.5	22.7	16.6	16.2	15.9	16.8	17.7	19.4	16.9	16.8	NA	NA	NA	NA	NA
Particle Size Distribution (ASTM D422)											NA	NA	NA	NA	NA
% Gravel	0.0	0.0	0.3	0.0	0.0	0.0	0.0 – 0.1	0.0	0.6	0.1					
% Sand	3.4 - 4.8	1.6 – 9.4	4.1 – 4.8	2.9 – 4.5	3.3 – 3.7	4.0 – 4.4	12.4 – 15.4	4.1 – 11.4	3.7 – 5.5	6.5 – 7.4					
% Fines	95.2 – 96.6	90.6 – 98.4	95.0 – 95.6	95.5 – 97.1	96.3 – 96.7	95.6 - 96	84.6 – 87.6	88.6 – 95.9	94.0 – 95.8	92.5 – 93.4					
Atterberg Limits (ASTM D4318)											NA	NA	NA	NA	NA
LL ^{c/} (%)	28	36	27	N.P. ^{f/}	24	25	23	28	26	N.P.					
PL ^{d/} (%)	21	22	21		22	21	22	22	21						
PI ^{e/} (%)	7	14	6		2	4	1	6	5						
Crumb Test (D6572-12)	2 ^{g/}	2	3	1	1	3	2	2	1	1	NA	NA	NA	NA	NA
Double Hydrometer Dispersion Test (D4221-11) (% Dispersion)	22.5	24.8	44.3	33.9	32.1	38.0	37.4	18.6	29.7	24.4	NA	NA	NA	NA	NA
In situ Density (lbs/ft ³) (ASTM D7263-09)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	90.8 (0' to 2')	77.5 (2' to 4') 78.1 (6' to 8')	80.2 (2' to 4') 81.7 (6' to 8')	70.4 (2' to 4') 94.7 (6' to 8')	79.3 (2' to 4') 77.3 (6' to 8')
In-situ Moisture Content (%) (ASTM D2216-10)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.9 (0' to 2')	4.8 (2' to 4') 6.0 (6' to 8')	15.1 (2' to 4') 9.4 (6' to 8')	15.5 (2' to 4') 5.9 (6' to 8')	8.4 (2' to 4') 8.6 (6' to 8')

Notes:
^{a/} ASTM American Society of Testing and Materials
^{b/} Not Analyzed
^{c/} LL: Liquid Limit
^{d/} PL Plastic Limit
^{e/} PI: Plasticity Index
^{f/} NP: Non-plastic

Table 3.2 Summary of WUA Soil Hydrological Testing and Associated Results

Test Pit/Boring I.D.	$K_{sat}^{b/}$ (cm/sec)	Van Genuchten Parameters ^{a/}			
		$\alpha^{c/}$ (cm^{-1})	$N^{d/}$ (dimensionless)	$\theta_r^{e/}$ (% vol)	$\theta_s^{f/}$ (% vol)
TP001	3.3E-05	1.0624	1.2659	0.0207	0.5257
TP004	1.4E-04	1.7409	0.2293	0.0431	0.4417
TP006	2.3E-05	0.5592	1.3116	0.0191	0.4776
TP007	5.8 E-05	0.8571	1.3562	0.0409	0.4865
TP008	7.87E-05	0.6665	1.4267	0.0543	0.5219
SB03 (2-15 feet)	2.6E-06	NA ^{g/}	NA ^{g/}	NA ^{g/}	NA ^{g/}
SB7 (6 to 8 feet bgs)	6.2E-05	NA ^{g/}	NA ^{g/}	NA ^{g/}	NA ^{g/}
SB7 (12 to 14 feet bgs)	3.1E-04	NA ^{g/}	NA ^{g/}	NA ^{g/}	NA ^{g/}

Notes:^{a/} Van Genuchten Parameters for SWCC testing (ASTM 6836)^{b/} K_{sat} = saturated hydraulic conductivity (ASTM D5084)^{c/} α = inverse of the air-entry value (or bubbling pressure)^{d/} n = pore size distribution index [dimensionless]^{e/} θ_r = residual water content^{f/} θ_s = saturated water content^{g/} NA = not analyzed

The DGWP specified that Soil Water Characteristic Curve Testing would be performed on disturbed samples remolded to both 85 and 90% of MDD. However, Water Characteristic Curve Testing was performed only on disturbed samples remolded to 85% MDD. The deviation was mainly due to the fact that the construction specifications for the cover soil (silt from the WUA) would target an in-place density of 85% MDD \pm 3%. This specification has been chosen to limit the in-place density to below 90% MDD. Therefore, Water Characteristic Curve Testing at 90% MDD was not warranted.

3.1.3 Agronomic Testing

Three (3) composite samples (CP01, CP02 and CP03), derived from the ten (10) test pits were sent off for agronomic testing. The agronomic testing was performed by ACZ Laboratories. The agronomic test performed and associated results are presented in Table 3.3. As indicated by Table 3.3, the results were consistent for the three samples. The laboratory reports for the agronomic testing are presented in Appendix E.

Table 3.3 Summary of WUA Soil Agronomic Testing and Associated Results

Analyses	Sample I.D.		
	WUA-CP01	WUA-CP02	WUA-CP03
Cation Exchange Capacity (meq/100g)	8.50	11.0	10.0
Phosphorus, total (mg/Kg)	790	780	790
Potassium, total (mg/Kg)	2410	2780	2620
Carbon, total organic (%)	0.2	0.2	0.2
Conductivity @25°C (mmhos/cm)	0.442	0.594	0.456
Organic Matter (%)	0.8	0.9	0.9
pH, Saturated Paste	8.6	8.4	8.5
Solids (%)	94.1	91.9	93.0
Nitrogen, ammonia (mg/Kg)	10.6	11.1	10.7

3.2 ROOT DENSITY TESTING

Root density testing was performed using the procedures described in the Work Plan. The results of the root density testing are summarized in Table 3.4. The laboratory report for the root density measurements are presented in Appendix F.

Table 3.4 Root Density Measurements

Sample	Grams of Roots per 100 grams of Soil
Grid #6—Location #1	
0-6 inches	0.019
6-12 inches	0.078
12-18 inches	0.003
Grid #6—Location #2	
0-6 inches	0.084
6-12 inches	0.019
12-18 inches	0.014
Grid #6—Location #3	
0-6 inches	0.032
6-12 inches	0.013
12-18 inches	0.005
Grid #7—Location #1	
0-6 inches	0.039
6-12 inches	0.020
12-18 inches	0.013
Grid #7—Location #2	
0-6 inches	0.036
6-12 inches	0.029
12-18 inches	0.021
Grid #7—Location #3	
0-6 inches	0.089
6-12 inches	0.024
12-18 inches	0.015
Grid #8—Location #1	
0-6 inches	0.102
6-12 inches	No sample
12-18 inches	0.020
18-24 inches	0.006
Grid #8—Location #2	
0-6 inches	0.076
6-12 inches	0.075
12-18 inches	0.013
18-24 inches	0.004
Grid #8—Location #3	
0-6 inches	0.048
6-12 inches	0.028
12-18 inches	0.013
Grid #13—Location #1	
0-6 inches	0.104
6-12 inches	0.036
12-18 inches	No sample
Grid #13—Location #2	
0-6 inches	0.064
6-12 inches	0.032
12-18 inches	No sample
Grid #13—Location #3	
0-6 inches	0.101
6-12 inches	0.034
12-18 inches	0.014
Grid #14—Location #1	
0-6 inches	0.087
6-12 inches	0.054
12-18 inches	0.016

Sample	Grams of Roots per 100 grams of Soil
Grid #14—Location #2	
0-6 inches	0.109
6-12 inches	0.051
12-18 inches	0.026
Grid #14—Location #3	
0-6 inches	0.053
6-12 inches	0.040
12-18 inches	0.019
Grid #15—Location #1	
0-6 inches	0.054
6-12 inches	0.018
12-18 inches	0.011
Grid #15—Location #2	
0-6 inches	0.077
6-12 inches	0.038
12-18 inches	0.008
Grid #15—Location #3	
0-6 inches	0.060
6-12 inches	0.023
12-18 inches	0.013
Grid #16—Location #1	
0-6 inches	0.069
6-12 inches	0.051
12-18 inches	0.016
Grid #16—Location #2	
0-6 inches	0.118
6-12 inches	0.044
12-18 inches	0.023
Grid #16—Location #3	
0-6 inches	0.083
6-12 inches	0.030
12-18 inches	0.016
Grid #17—Location #1	
0-6 inches	0.093
6-12 inches	0.024
12-18 inches	0.013
18-24 inches	0.005
Grid #17—Location #2	
0-6 inches	0.052
6-12 inches	0.020
12-18 inches	0.015
18-24 inches	0.002
Grid #17—Location #3	
0-6 inches	0.037
6-12 inches	0.031
12-18 inches	0.015
18-24 inches	0.006
Grid #18—Location #1	
0-6 inches	0.014
6-12 inches	0.018
12-18 inches	0.003
Grid #18—Location #2	
0-6 inches	0.068
6-12 inches	0.023
12-18 inches	0.013
Grid #18—Location #3	

Sample	Grams of Roots per 100 grams of Soil
0-6 inches	0.041
6-12 inches	0.022
12-18 inches	0.011

As indicted in Table 3.4, 3 discrete interval samples were not analyzed. The two Grid # 13 samples collected at an interval of 12- 18-inches were not sent to the lab due to the presence of shallow slag, which precluded obtaining a hand-auger sample. The sample associated with Grid #8 for the 6 to 12 inch interval was not analyzed because the quart size bag sample bag was reported as torn when received at the laboratory and was evidently damaged during shipment. All other samples were inspected upon arrival and determined to be intact.

4.0 Data Gap Findings and Conclusions

This section presents recommendations for the design parameters to be used in the Remedial Design (RD). ProUCL 5.0 Statistical Software was used to calculate the means for the design parameters shown in the table below. The results of the ProUCL analysis are presented in Appendix H. As shown in Appendix H, the data for the geotechnical and hydrological parameters were generally normally distributed and hence the use of mean values for these parameters in the remedial design is appropriate.

4.1 GEOTECHNICAL RECOMMENDATIONS

The main purpose of the geotechnical testing was to define appropriate design parameters of the WUA borrow soil for use in ET soil cover modeling, to estimate volume of soil required from the WUA, and evaluate the WUA soils susceptibility to erosion and desiccation cracking. The proposed geotechnical design parameters for the WUA borrow soil are summarized Table 4.1.

Table 4.1 Recommended Geotechnical Design Parameters for WUA Borrow Soil

Parameter	Value
MDD (lbs/ft ³) per ASTM D698	104.2 (mean)
OMC (%) per ASTM D698	17.1 (mean)
In situ Density (lbs/ft ³) per ASTM D7263-09	81.1 (mean)
In-situ Moisture Content (%) per ASTM D2216-10	8.7 (mean)

A review of particle size distribution curves and Atterberg Limits, which are known to be key soil index properties, suggest that the silts within the WUA are very uniform. Although disturbed grab samples were not collected at depths deeper than 10 feet, visual observations of the silts below 10 feet in test pits and soil borings indicate that the soils are uniform in terms of soil color, texture, plasticity, and grain size. Therefore, the physical properties of the silts at deeper depths are adequately represented by the grab samples collected to a depth of 10 feet.

Atterberg limits and dispersive testing was performed on the majority of disturbed samples to assess the potential for desiccation cracking and erosion of the silts. Based on the Atterberg limits testing, the plasticity index (PI), ranged between 1 and 14. These results indicate that the soils have very low-plasticity and therefore are not susceptible to desiccation cracking associated with volumetric changes (shrinkage) induced by moisture fluctuations. The results of the dispersion testing both (Crumb and double hydrometer testing) indicate that the soils are generally non-dispersive to moderately dispersive based on Crumb test results characterizing the

majority of samples being between a Grade 1(non-dispersive) and 2 (intermediate) and double hydrometer testing ranging between 18.6 and 44.3 percent dispersion. Therefore, based on these results, there is nothing to preclude the WUA soils being used as capping soil.

4.2 HYDROLOGICAL RECOMMENDATIONS

The main purpose of the hydrological testing was to define appropriate design parameters of the WUA borrow soil for use in the modeling of the ET soil cover. The proposed hydrological design parameters for the WUA borrow soil are summarized Table 4.2.

Table 4.2 Recommended Hydrological Design Parameters for WUA Borrow Soil

Parameter	Value
Hydraulic Conductivity (cm/sec) per ASTM 5084	6.57E-5 (mean)
Van Genuchten Parameters (per ASTM 6836)	
α (cm)	0.97722 (mean)
n (dimensionless)	1.11794 (mean)
θ_r (%vol)	0.03562 (mean)
θ_s (%vol)	0.49068 (mean)

4.3 ROOT DENSITY RECOMMENDATIONS

The main purpose of the root density testing was to provide a quantification of the vegetation quality that can be established for use in the ET soil cover modeling. Based on the ProUCL analysis presented in Appendix H, a mean was selected resulting in a design root density value of 0.051 grams of roots per 100 grams of soil.

4.4 STORMWATER SEWER VIDEO SURVEY FINDINGS

A summary of the stormwater sewer piping video survey is provided in Table 4.3 presenting the total volume of solids expected to be removed, characterized, and disposed as result of the RA-A stormwater sewer pipe cleaning. While the video survey did not identify any P4 present in the stormwater sewer piping, all precautions will be taken during cleaning of the piping in the event P4 is encountered. Also, while the waste determination performed on the decon water and sediments collected during the video survey indicated that the water and sediments were non-hazardous, wastes generated during the cleaning of the stormwater sewer piping will be fully characterized.

4.5 BORROW SOURCE AVAILABILITY

In addition to collecting disturbed and undisturbed soil samples, the WUA soil investigation was also used to characterize the approximate quantity of borrow soil available for use during the remedial action. The depth information obtained from the soil boring and test pit were used to develop an isocontour map of the depth of silt throughout the WUA and is presented in Figure 4-1. Based on Figure 4-1, there is approximately 2.4 million CY of soil (silt) available for use in the ET and Gamma soil covers. The preliminary required soil volume based on a 12-inch gamma cap and 30-inch ET cover is approximately 1.3 million CY. Therefore, there is ample soil available in the WUA to support the RA.

Table 4.3 Summary of Stormwater Sewer Piping Video Survey

Piping Segment	Total Segment Length (ft)	Pipe Construction	Pipe OD/ID (in)	Total Segment Volume (ft ³)	Percent Full of Sediment %	Maximum Sediment Volume to be Removed per Segment ¹ (ft ³)	Evidence of P4?
West Discharge to Area Inlet #1	129	concrete	16/11.5	93	70	65	No
East Discharge to Area Inlet #1	85	concrete	16/11.5	61	10	6	No
Area Inlet #4 to Area Inlet #3	107	concrete	16/11.5	77	100	77	No
Area Inlet #4 to Area Inlet #2	170	steel	8/7.98	60	70	42	No
Area Inlet #5 to pipe junction	180	steel	8/7.98	62	70	43	No
Manhole #1 to Area Inlet #3	169	concrete	16/11.5	122	50	61	No
Total Maximum Sediment to be Removed						294	

¹ This "maximum" sediment volume is a conservative estimate for waste management planning purposes.

5.0 REFERENCES

EPA, 2012. Interim Amendment to the Record of Decision for the EMF Superfund Site - FMC Operable Unit - Pocatello, Idaho (IRODA), September 27, 2012.

EPA, 2013. Unilateral Administrative Order for Remedial Design and Remedial Action, EPA Docket No. CERCLA-10-2013-0116 (UAO for RDRA), June 10, 2013.

MWH, 2010. Supplemental Feasibility Study Report for the FMC Plant OU, MWH Americas, Inc., July 2010.

MWH, 2013a. Remedial Design Work Plan, MWH Americas, Inc., August 2013.

MWH, 2013b. Remedial Design Data Gap Work Plan, MWH Americas, Inc., October 2013.

Figures

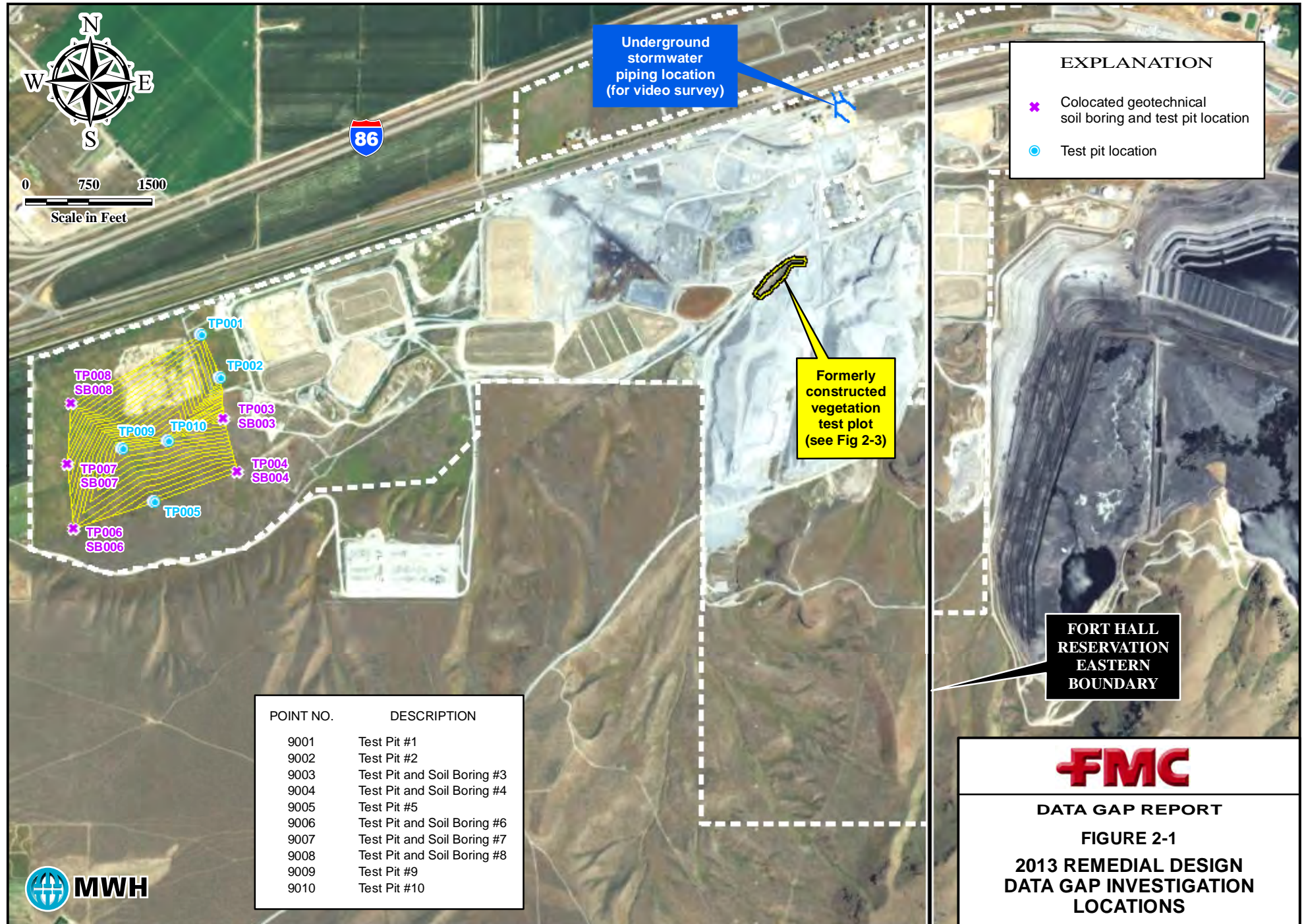
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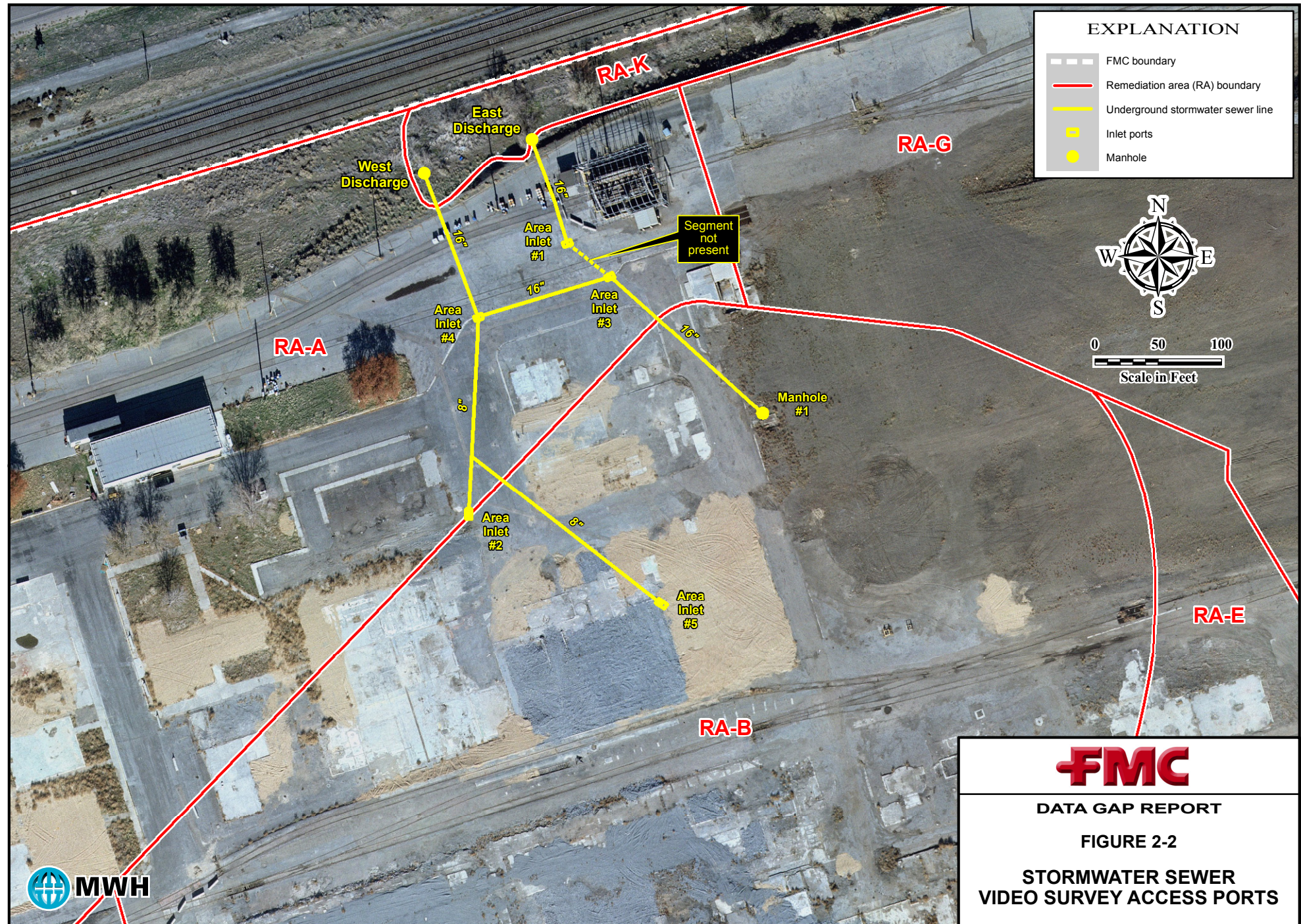
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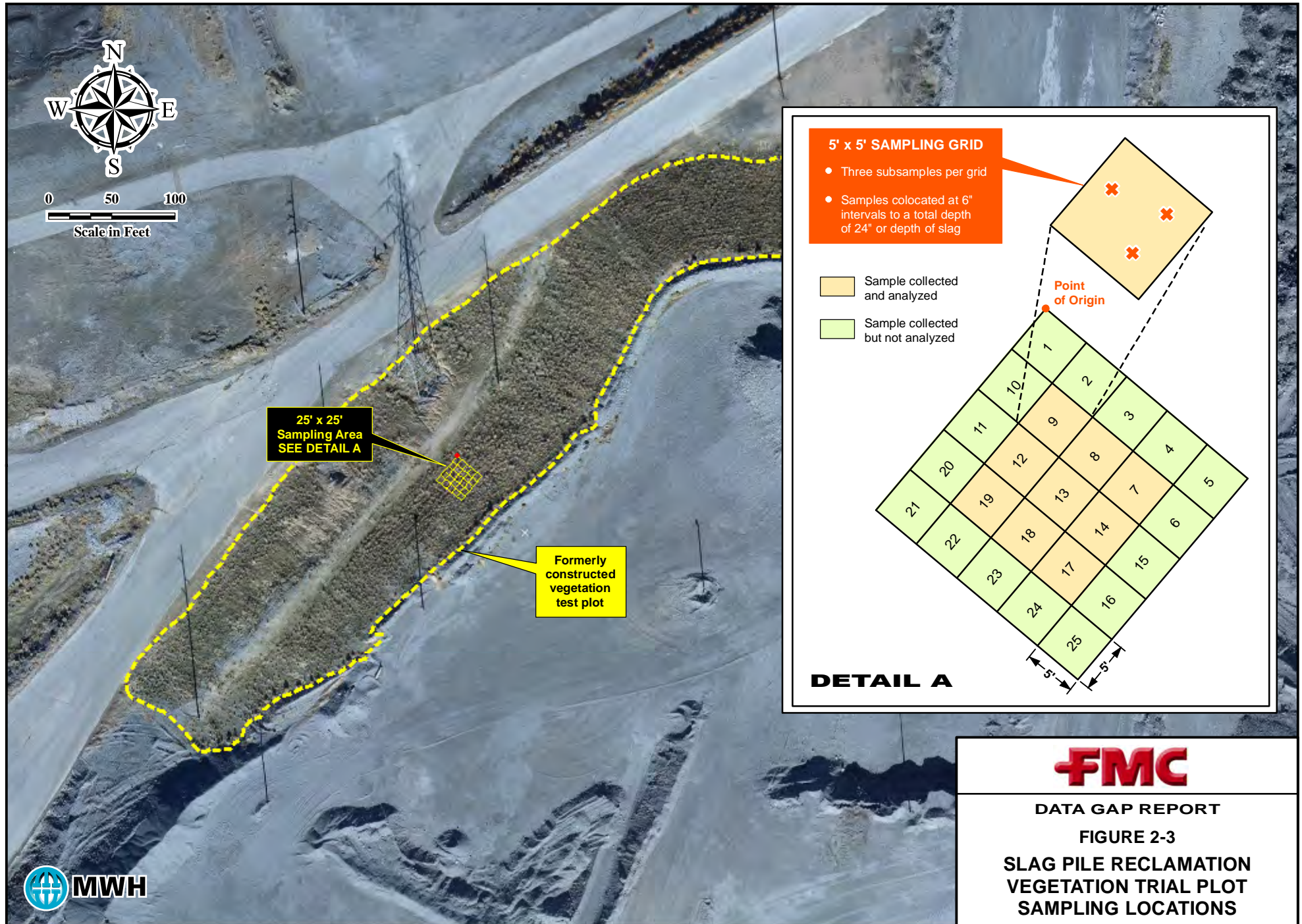


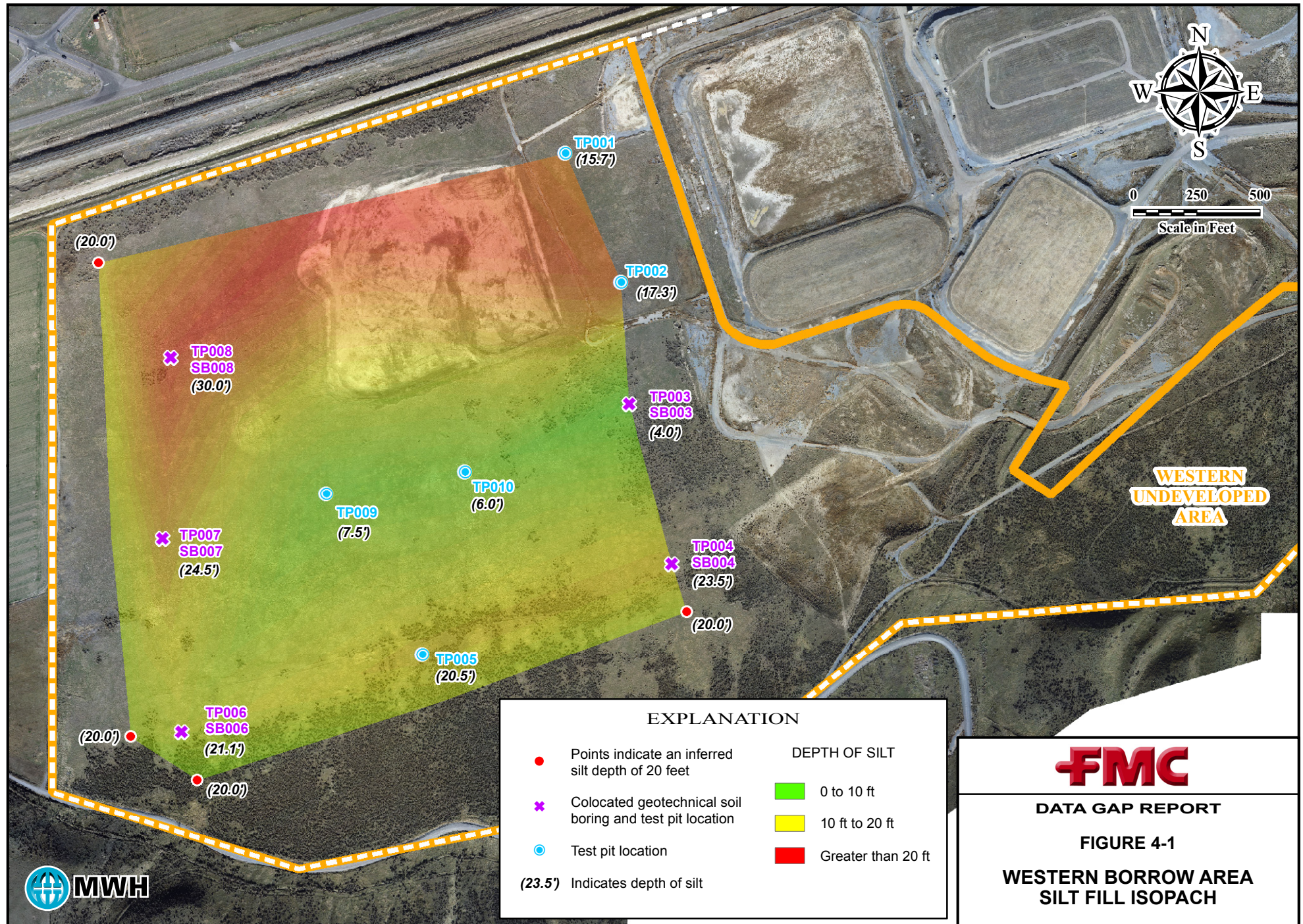
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DATE: 27 Jan 2014









APPENDIX A

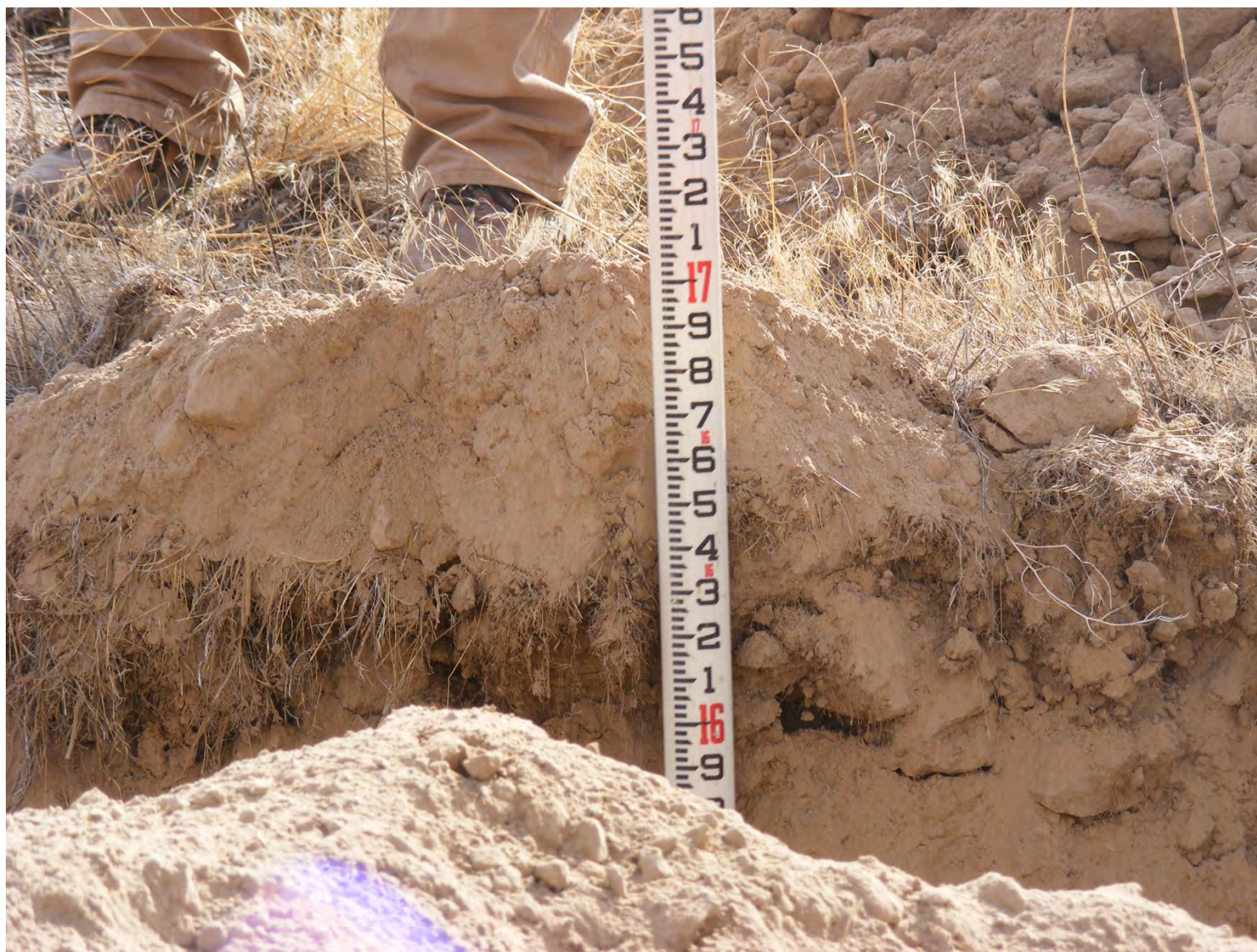
Field Investigation Photographs



Photograph 1 (taken 10/29/2013) – Looking at base of excavation in TP001.



Photograph 2 (taken 10/29/2013) – Looking at shallow gravels contacted in TP003 .



Photograph 3 (taken 10/29/2013) – Looking at depth measurement taken at the base of TP004.



Photograph 4 (taken 10/30/2103) – Looking at base of excavation in TP005.



Photograph 5 (taken 10/30/2013) – 6-inch minus gravels excavated from TP009 encountered at 7.5 feet bgs.



Photograph 6 (taken 11/12/2013) – Core taken from SB004 showing silt borrow material collected from 20 to 21.5 feet bgs.



Photograph 7 (taken 11/12/2013) – Core taken from SB004 showing gravels collected from 25 to 26.5 feet bgs.



Photograph 8 (taken 11/13/2013) – Looking southwest at hollow-stem auger drill rig at SB008.



Photograph 9 (taken 11/06/2013) – Looking south at video survey equipment in 16-inch reinforced concrete pipe in entrance to East Discharge.



Photograph 10 (taken 11/06/2013) – Video survey equipment lowered into manhole.



Photograph 11 (taken 11/06/2013) – Video survey control room.



Photograph 12 (taken 11/06/2013) – Decontamination of video survey equipment.

APPENDIX B

Test Pit Logs

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investigation

Project Number 10503311

Sample Location WVA

Trench Number TP001

Date 10/29/2013

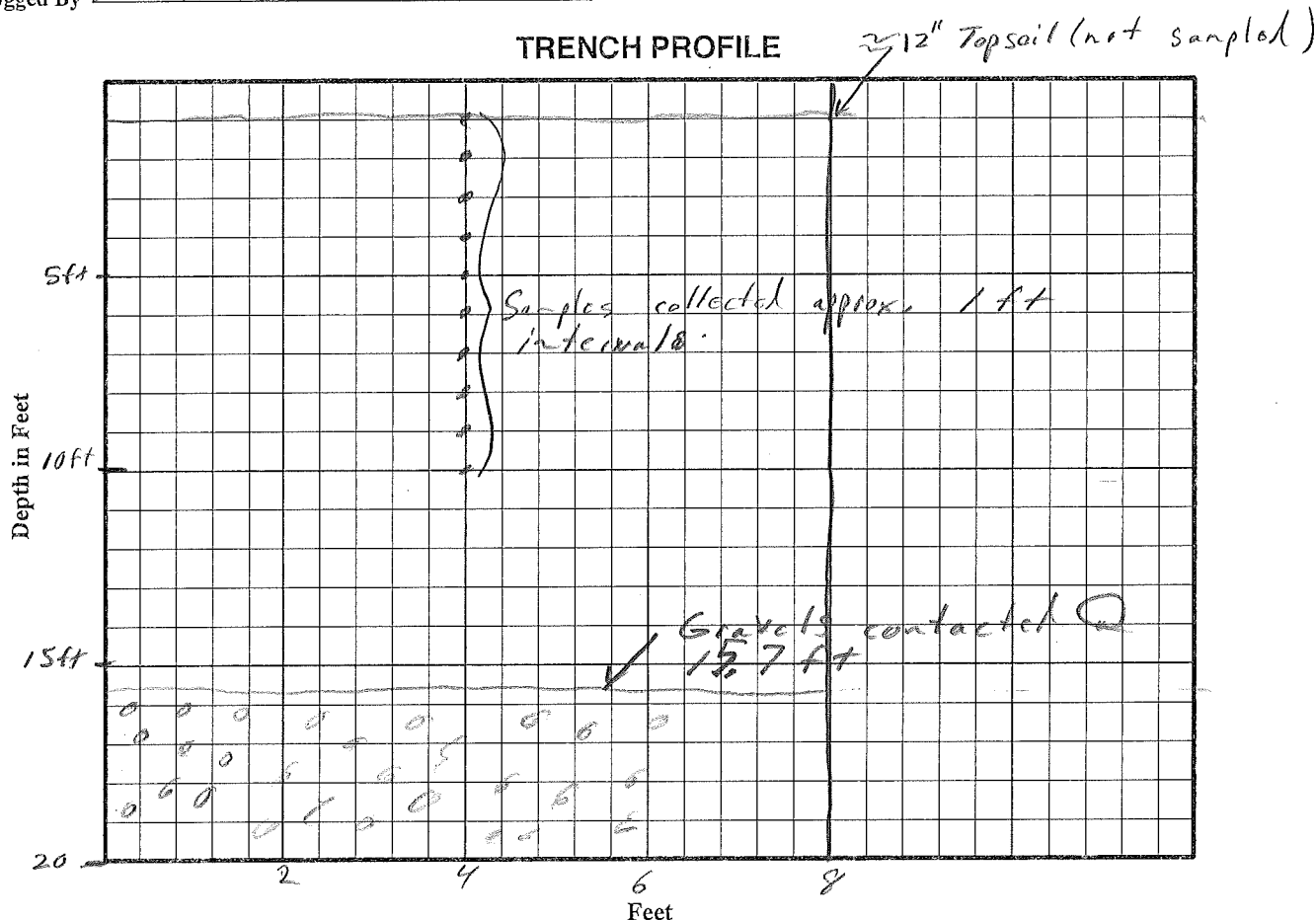
Coordinates: Inside Stake 442820.8 N

Eastings 548752.9 S

Elevation Native/Fill Stake 4441 ft amsl

Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

12" Top soil with extensive roots
 14.7' of silt (ML), (Brown), (Low plasticity), moderate density, dry
 15.7" gravel contacted, Gravel appeared to be quartitic in nature. Mainly 4" minus.

Begin Trench 9:50

Finish Trench 10:25

Trenching Contractor KW

Total Depth 15.7 ft

Total Length 8 ft

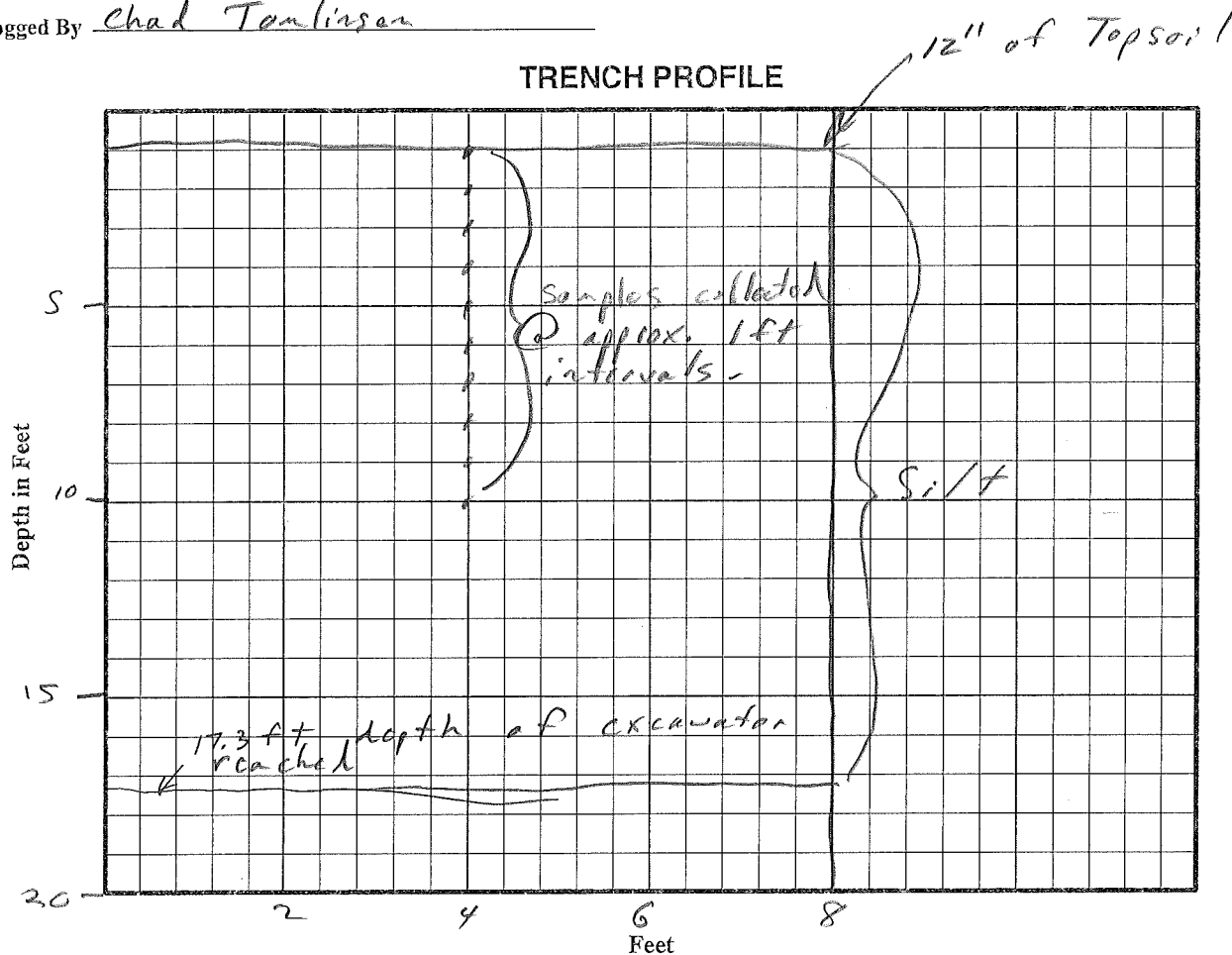


TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investigator Project Number 10503311
 Sample Location WVA Trench Number TP002 Date 10/29/2013
 Coordinates: Nothing Inside Stake 449308.2 Easting 548972.9
 Elevation Native/Fill Stake 4441.8
 Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Excavated to total depth of 17.3 ft. Native
silt encountered as in TP001.

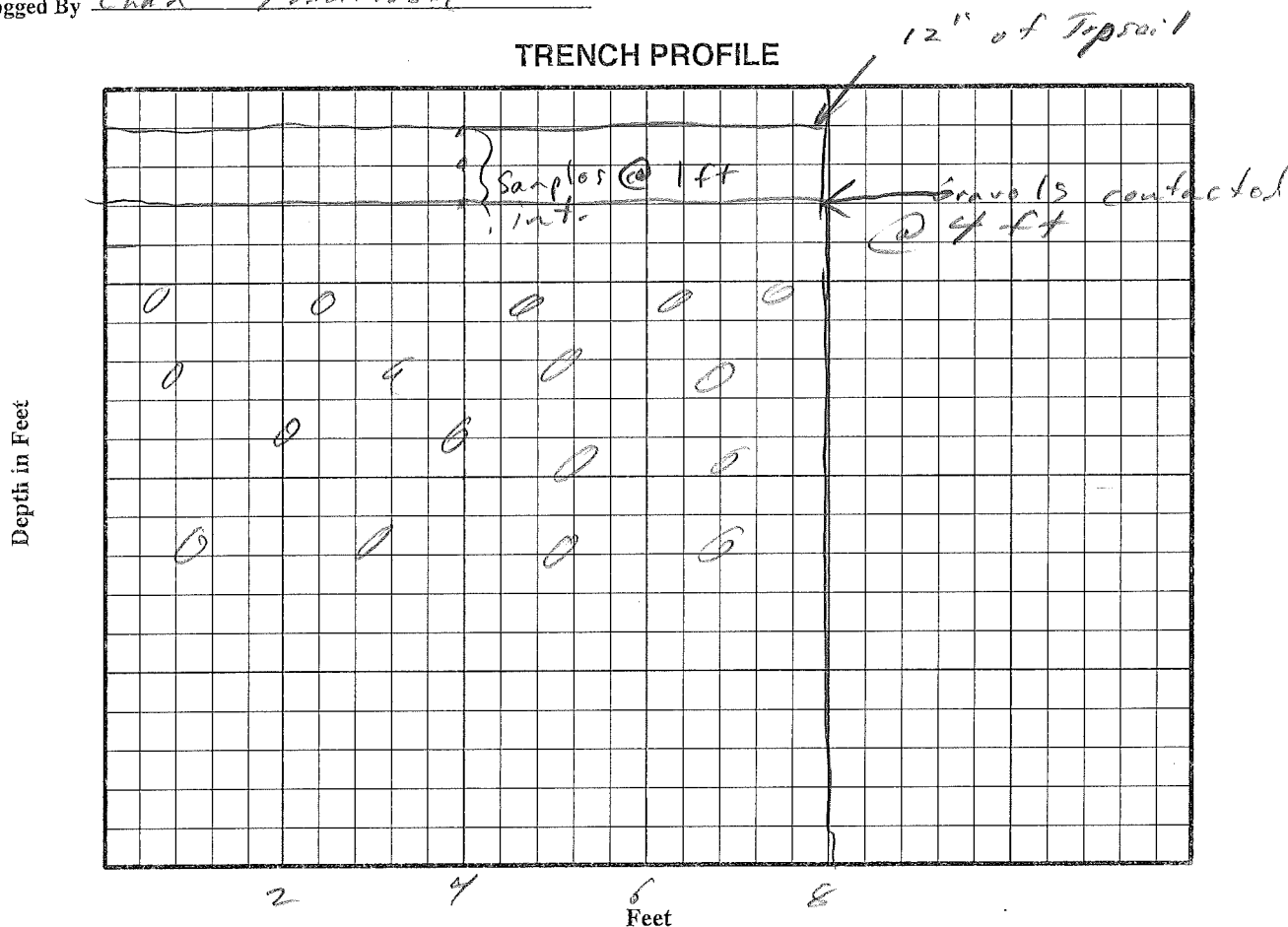
Begin Trench 10:36 Finish Trench 11:13 Trenching Contractor Kw
 Total Depth 17.3 Total Length 8

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investigation Project Number 11513311
 Sample Location WVA Trench Number TP003 Date 10/29/2013
 Coordinates: North Inside Stake 448827.0 East Outside Stake 549003.4
 Elevation Native/Fill Stake
 Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

12" of top soil with extensive root structure
3' of silt (refer to TP001 for description of silt)
Gravels contacted @ 4ft

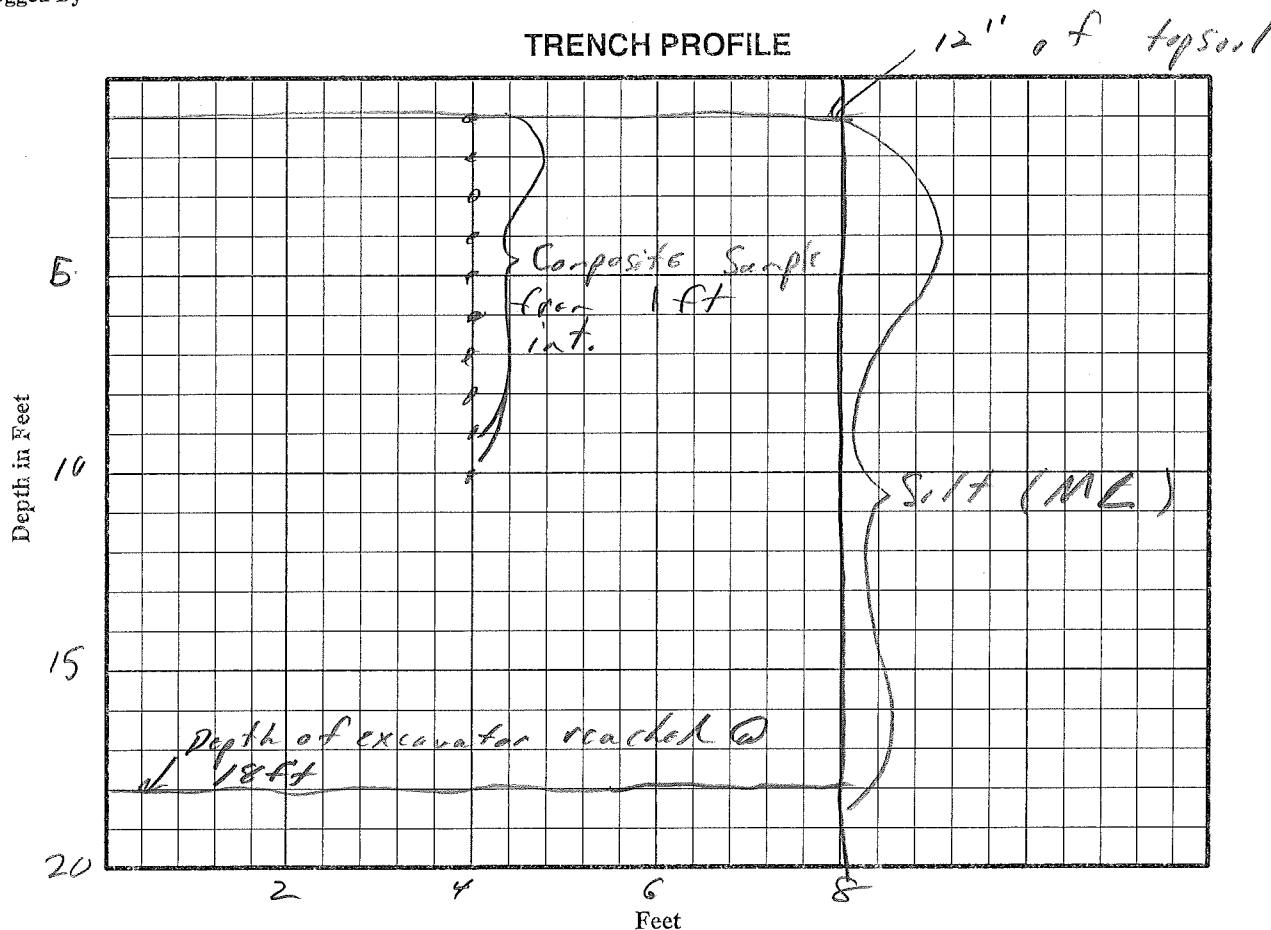
Begin Trench 11:23 Finish Trench 11:30 Trenching Contractor KW
 Total Depth 4 ft Total Length 8

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investigation Project Number 10503311
 Sample Location WUA Trench Number TP004 Date 10/29/2013
 Coordinates: Inside Stake 448196.6 Outside Stake 549171.6
 Elevation 4453.5
 Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for description of silt

Begin Trench 13:25 Finish Trench 13:55 Trenching Contractor KW
 Total Depth 18 Total Length 8

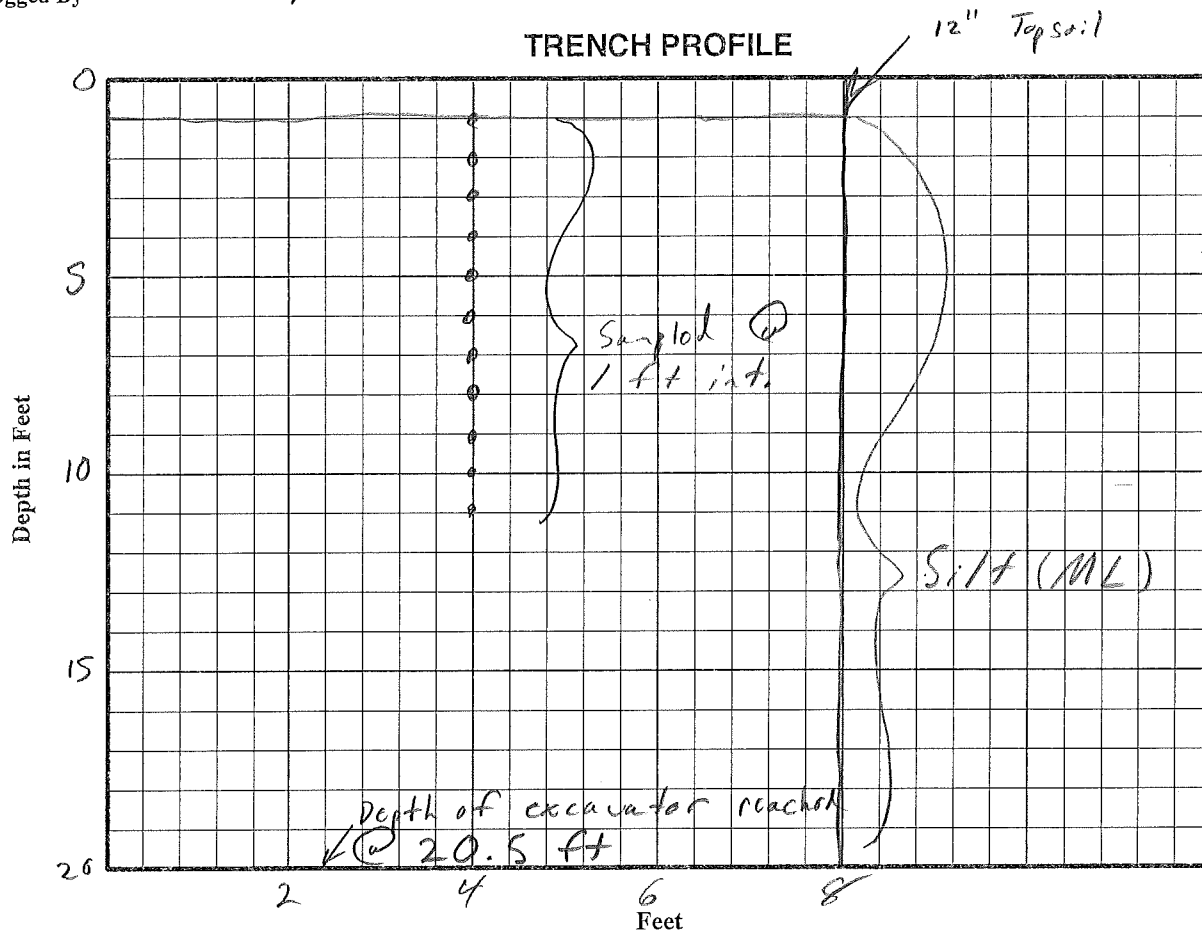


MWH

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investigation Project Number 10503311
 Sample Location NVA Trench Number TP005 Date 10/29/2013
 Coordinates: Inside Stake 447835.6 Easting 548187.9
 Elevation 4450.5 Native/Pit Stake
 Logged By Chad Tomlinson



Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for description of silt

Begin Trench 14:05 Finish Trench 14:37 Trenching Contractor KW
 Total Depth 20.5 ft Total Length 8

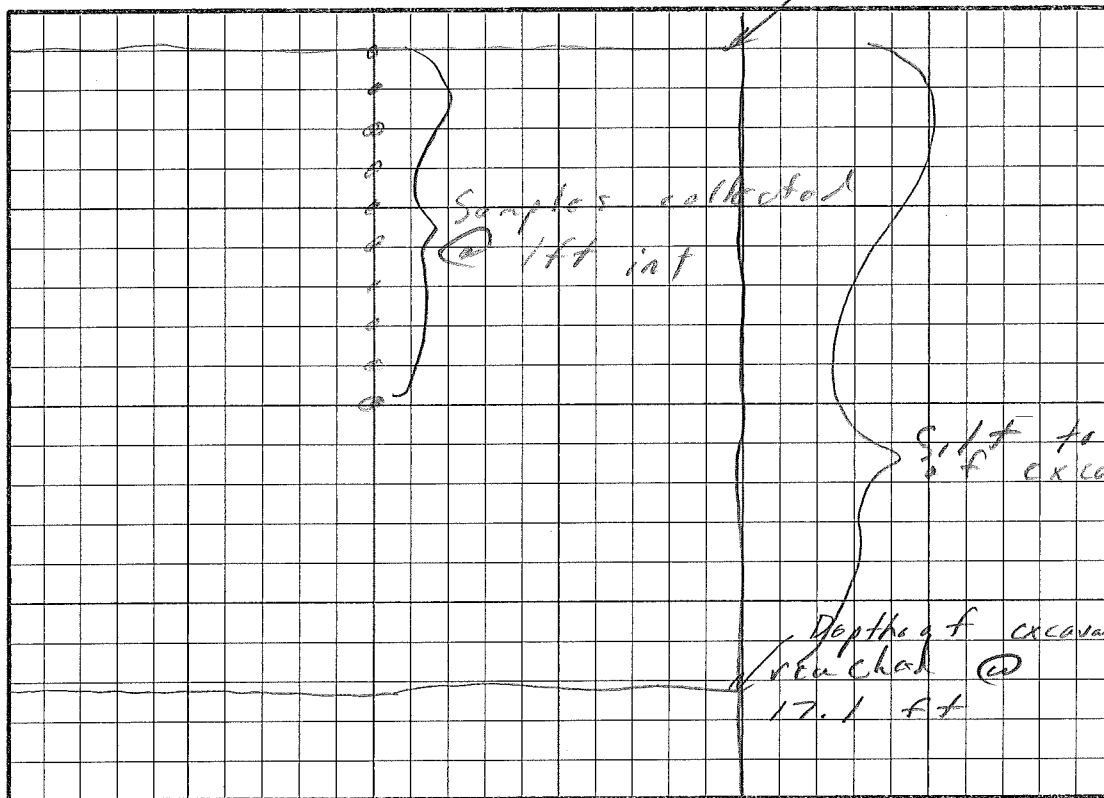
TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Investigation Project Number 10503311
 Sample Location WVA Trench Number TP006 Date 10/29/2013
 Coordinates: Inside Stake 447529.7 Outside Stake 547237.3
 Elevation Native/Fill Stake 4454.9
 Logged By Chad Tomlinson

TRENCH PROFILE

Depth in Feet



Feet

Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for description of silt

Begin Trench 14:45 Finish Trench 15:11 Trenching Contractor KW
 Total Depth 17.1 ft Total Length ~ 8 ft



TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Invest

Project Number 10503311

Sample Location WVA

Trench Number TP007

Date 10/30/13

Coordinates: Inside Stake 448275.4

Outside Stake 547160.5

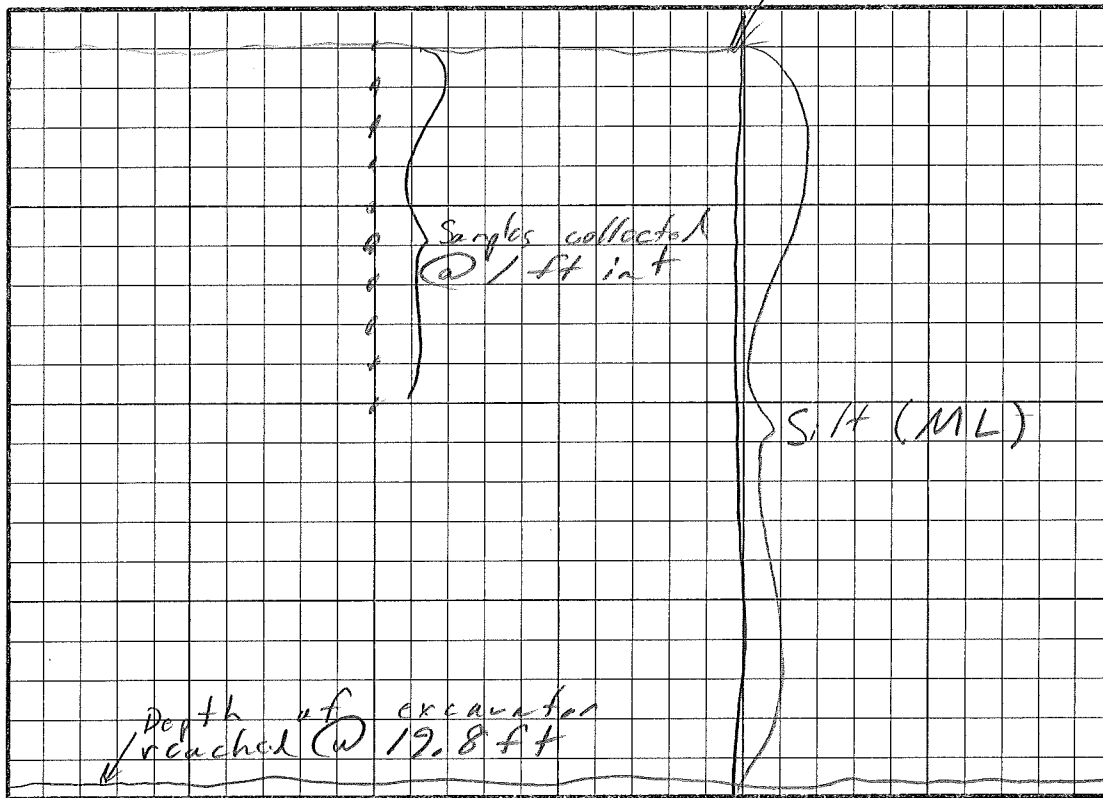
Elev Native/Fill Stake 4452.9

Easting

Logged By Chad Tomlinson

TRENCH PROFILE

Depth in Feet



Feet

Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for S.H description

Begin Trench 10:20

Finish Trench 10:48

Trenching Contractor KW

Total Depth 19' 2"

Total Length 8

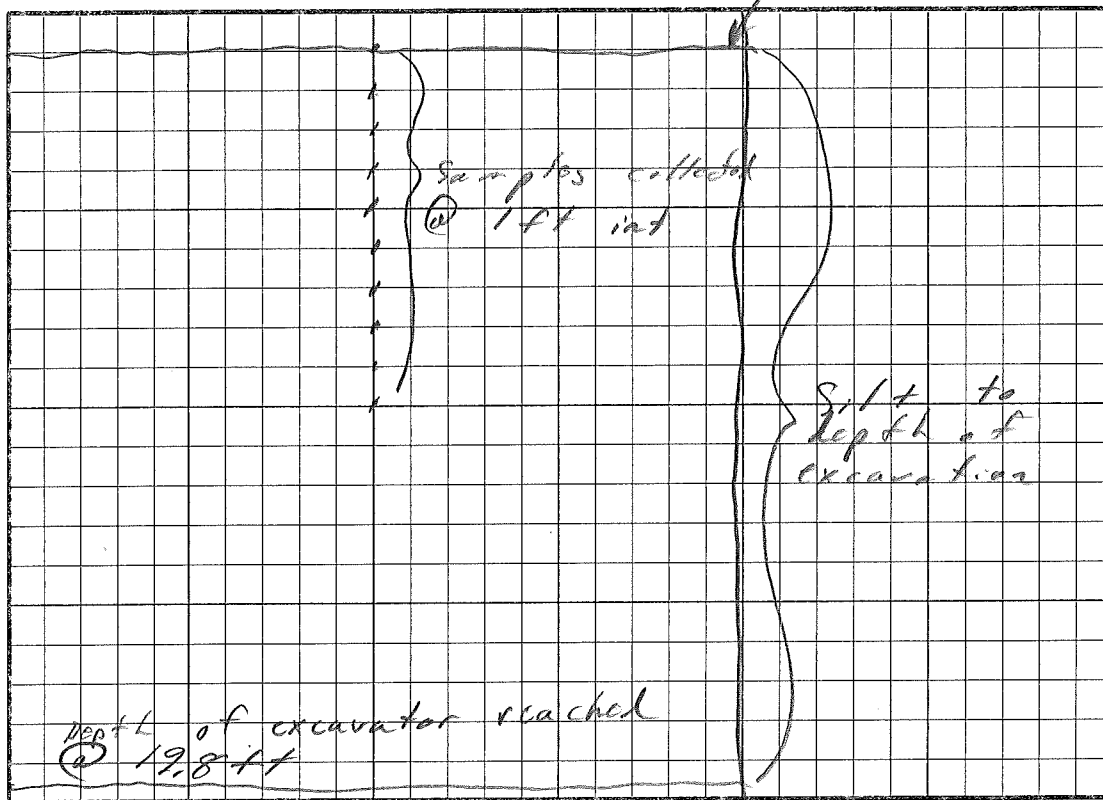
TRENCH TEST PIT LOG FORM

Page ____ of ____

Project FMC Data Gap Invest Project Number 10503311
 Sample Location WVA Trench Number TP008 Date 10/30/13
 Coordinates: Northing 442010.0 Easting 547194.5
Flr Native/Fill Stake 4451.7
 Logged By Chad Tomlinson

TRENCH PROFILE

Depth in Feet



Feet

Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for silt description

Begin Trench 11:00 Finish Trench 11:33 Trenching Contractor KW
 Total Depth 19' 8" Total Length 8

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project FMC Data Gap Invest.

Project Number 10503311

Sample Location WUA

Trench Number TP009

Date 10/30/13

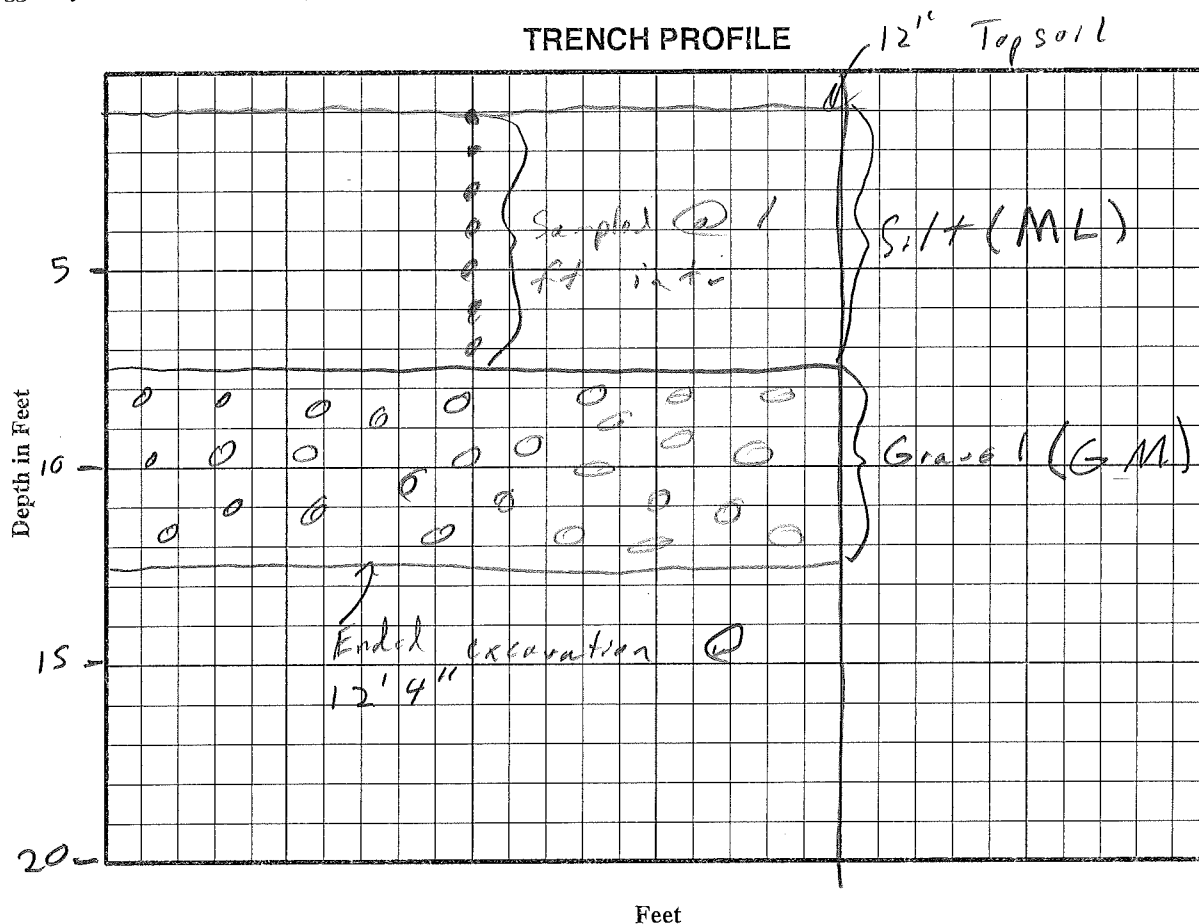
Coordinates: Inside Stake 448471.8

Outside Stake 547809.6

Elev Native/Fill Stake 4448.0

Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Refer to TP001 for soil description

Begin Trench 11:49

Finish Trench 12:07

Trenching Contractor KW

Total Depth 12' 4"

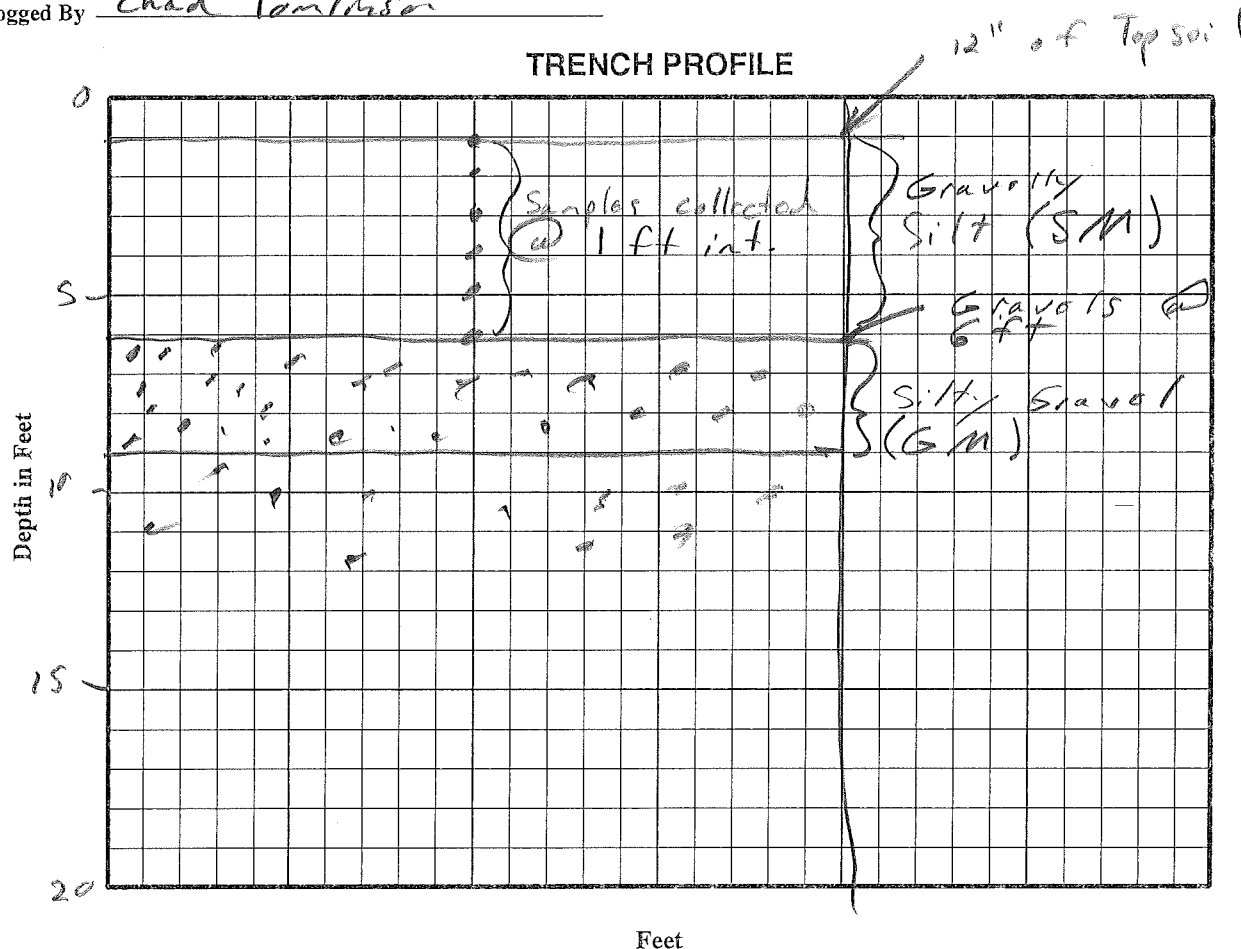
Total Length 8



TRENCH TEST PIT LOG FORM

Page 1 of 1Project EMC Data Gap InvertProject Number 10503311Sample Location WVATrench Number TP010Date 10/30/13Coordinates: Inside Stake N 448557.3Outside Stake E 548356.9Elev Native/Fill Stake 4446.2Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications

(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

Gravels (GM) encountered @ 8 ft excavated down to 9 ft and still in gravels. Excavated additional exploratory borings N + S of TP010. Appears that shallow gravels extend approx 300 ft N + S of TP010

Begin Trench 12:25Finish Trench 13:00Trenching Contractor KWTotal Depth 9Total Length 8

MWH

DATE 10/29/13

DAILY QUALITY CONTROL REPORT

DAY S M ~~T~~ W TH F S

WEATHER	Bright Sun	Clear	Overcast	Rain	Snow
TEMP	To 32	32-50	50-70	75-85	85 up
WIND	Still	Moder.	High	Report No.	
HUMIDITY	Dry	Moder.	Humid	D6FL-1	

PROJECT FMC Data Gap Investigation
 JOB NO. 10503311
 LOCATION WVA
 CONTRACT NO. _____

PERSONNEL AND SUBCONTRACTORS ON SITE:

KW: Mark Smith, Rick , Tribe: Kelly Wright
 MWH: Chad Tomlinson Booz

VISITORS ON SITE:

EQUIPMENT ON SITE: Trackhoe, front-end loader, shovels, buckets

WORK PERFORMED (INCLUDING SAMPLING):

Excavated TP001, TP002, TP003, TP004, TP005 and TP006. Collected samples from every 1 ft interval down to approximately 10 ft. Filled 2 5-gallon buckets at each test pit. Continued excavation below 10 ft until underlying gravels reached or depth of excavator met. Gravels contacted in 2 test pits: 1) TP001 @ 15.7 ft and 2) TP003 @ 4 ft. TP002, TP004, TP005, and TP006 excavated to total depth of excavator generally around 17.5 to 20 ft bgs. #P

PROJECT FMC Data Gap Field Investigation

REPORT NO. DGFJ-1

JOB NO. 105 03311

DATE 10/29/13

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

No field measurements completed

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

Level D (modified)

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

Complete remaining test pits

DISTRIBUTION : 1. MW PROJECT MANAGER
2. PROJECT FILE

Page 2 of 2

SUBMITTED BY Chad Tomlinson TITLE Project Engineer

DATE 10/30/13

DAILY QUALITY CONTROL REPORT

PROJECT FMC Data Gap Investigation
 JOB NO. 10503311
 LOCATION WVA
 CONTRACT NO. _____

DAY S M T W TH F S

WEATHER	Bright Sun	Clear	Overcast	Rain	Snow
TEMP	To 32	32-50	50-70	75-85	85 up
WIND	Still	Moder.	High	Report No.	
HUMIDITY	Dry	Moder.	Humid	D6FI-2	

PERSONNEL AND SUBCONTRACTORS ON SITE:

KW: Mark Smith, Rick
 MWH: Chad Tomlinson

VISITORS ON SITE:

EQUIPMENT ON SITE: Trackhoe, front-end loader, shovels, buckets

WORK PERFORMED (INCLUDING SAMPLING):

Excavated TP007-TP010. TP008 and TP010 were only test pits that contacted gravels. TP009 gravels @ 2.5 ft. TP010 gravels @ 6 ft. Performed additional test pits to define N-S extent of gravels @ TP000. Appears that gravels extend approximately 300 ft N and S of TP010 and in line with TP003 and TP009. Excavated additional test pit in southwest corner of existing borrow source. Excavated down to 20 ft below existing grade (10 below natural) w/o hitting gravels.

PROJECT FMC Data Gap Investigation

REPORT NO. DGFI-2

JOB NO. 10503311

DATE 10/30/13

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

No field tests completed. Took approximate depth measurements of test pits

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

Modified Level D

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

None

SPECIAL NOTES:

None

TOMORROW'S EXPECTATIONS:

No activities planned for tomorrow

DISTRIBUTION: 1. MW PROJECT MANAGER
2. PROJECT FILE

Page 2 of 2

SUBMITTED BY Chad Tomlinson

TITLE Project Engineer



APPENDIX C

Soil Boring Logs

BORING LOCATION	Project: <u>Data Gap</u> Project No: <u>10503311</u>	Boring ID: <u>FMC-SB-3</u>
	Date Drilled: <u>11/12/13</u> Date Completed: <u>11/12/13</u>	Northing: <u>448227.0</u> Easting: <u>549003.4</u>
	Logged By: <u>B. Bragdon</u>	Ground Surface Elevation (ft.): <u>4447.0</u>
	Water Elevation (ft.): <u>NA</u>	Datum: <u>NGVD (1988)</u>
	Date Measured: <u>NA</u>	
Total Depth (ft.): <u>30'</u>	Drilling Contractor: <u>Cone Tec / Job</u>	
Diameter (in.): <u>8"</u>	Drilling Method: <u>HSA</u>	
Abandonment Information: <u>Back filled with soil cuttings</u>		

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE	SAMPLE RECOVERY	USCS/ASTM CLASSIFICATION	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
1	0	15	100			Shelby Tube / GMB		ML		silt (ML) light gray (10YR 7/2) slightly to low plasticity, dry, few roots and organics, medium stiff	Time 1309
2	70	15	30					GM		Pushed Shelby Tube 0-2' in second borings #Rock @ 2' bgs unable to drive Shelby Tube from 2-4'	
3										Silty fine & coarse gravel (GM) light gray (10YR 7/2) low plasticity, medium dense, dry, sub rounded w/ few sub angular gravels	
4								GM		Shelby Tube Not Collected in GM	
5	70	15	30		15 C						
					25						

* C California Split Spoon Sampler (2.5" I.D.)
 S Standard penetration test sampler
 c Cuttings
 ▼ Elevation of ground water

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
5					18			GM			1330
6											
7											
8										Shelby Tube Not Collected in GM	
9											
10	70	30	15		8	C		GP		fine to medium sandy fine & coarse gravel w/ few cobbles, brown (1045/3)	
11					12					dirty, dense, subrounded w/ few broken angular gravels, nonplastic	
12					10						1350
13											
14											
15											

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FILE: FMC MW Log Form pg 2.ai 1004351.010604 04/03/2007 SLC

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
15					12	C					1411
16	60	30	10		16		↑	GP		As Above w/ some silt (10%)	1411
17					16		↓				
18											
19											
20	50	40	10		5	C		GP		fine to coarse sandy fine & coarse gravel, mainly fine gravel, yellowish brown (10YR 5/4) dry, non plastic	
21					6		↑			large, sub rounded.	1419
22											
23											
24											
25											

PAGE 4 OF 4

BORING LOCATION	Project: <u>Databop</u> Project No: <u>1050331</u>	Boring ID: <u>FMC SB-4</u>
	Date Drilled: <u>11/12/13</u> Date Completed: <u>11/12/13</u>	Northing: <u>448196.6</u> Easting: <u>549171.6</u>
	Logged By: <u>B. Bragdon</u>	Ground Surface Elevation (ft.): <u>4453.5</u>
	Water Elevation (ft.): <u>NA</u>	Datum: NGVD (1988)
	Date Measured: <u>NA</u>	
	Total Depth (ft.): <u>30'</u>	Drilling Contractor: <u>Cone Tec / Joff</u>
	Diameter (in.): <u>8"</u>	Drilling Method: <u>HSA</u>
Abandonment Information: <u>Backfilled with soil cuttings</u>		

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICATION	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
1	0	100	100			SPT-B		ML		silt (ML) light gray (10YR 7/2) slightly to low plasticity, dry, few roots and organics, medium stiff	1542
2						Shelby Tube		ML			
3											
4								ML		Pushed Shelby Tube 2'-4'	1548
5											

* C California Split Spoon Sampler (2.5" I.D.)
 S Standard penetration test sampler
 c Cuttings
 ▽ Elevation of ground water

FILE: FMC MW Log Form pg 2.ai 1004931.010604 04/03/2007 SLC

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
5											Time
6											
7						Shelby Tube		ML			
8								ML		Pushed Shelby Tube 6'-8'	1620
9											
10	0	5	100		3	C		ML		silt (ML) pale brown (10YR 7/3) dry	
11					3					low plasticity, dry, soft to	
					5					medium stiff.	1628
12											
13											
14											
15											

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
15	0	25	100		7	C		ML		Silt (ML), pale brown (10YR 7/3) dry, low to slightly plastic, medium stiff	1645
16					8					to stiff.	
					10						
17											
18											
19											
20	0	25	100		7	C		ML		Silt (ML), pale brown (10YR 7/3) dry, low to slightly plastic, medium stiff to stiff.	1654
21					14						
					11						
22											
23											
24								GP		harder drilling about 23.5' Estimated top of Gravel.	
25											

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[illegible]

BORING LOCATION	Project: <u>FMC</u> Project No: <u>10503311</u>	Boring ID: <u>FMC-SB-0</u>
	Date Drilled: <u>11/13/17</u> Date Completed: <u>11/13/17</u>	Northing: <u>4411529.7</u> Easting: <u>547237.3</u>
	Logged By: <u>Bill Braggdon</u>	Ground Surface Elevation (ft.): <u>4454.9</u>
	Water Elevation (ft.): <u>NA</u>	Datum: <u>NGVD (1988)</u>
	Date Measured: <u>NA</u>	
	Total Depth (ft.): <u>30'</u> Diameter (in.): <u>8"</u>	Drilling Contractor: <u>Cone Tec / Jeff</u> Drilling Method: <u>HSA</u>
Abandonment Information: <u>Back filled with soil cuttings.</u>		

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICATION	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
1	0	25	100			SP18		ML		Silt (ML) light gray (10YR 7/2) to Pale brown (10YR 7/3), slightly to low plasticity, medium stiff, few roots and organics.	853
2											
3											
4						Shelby Tube		ML		Dashed Shelby Tube 2'-4'	906
5											

* C California Split Spoon Sampler (2.5" I.D.)
 S Standard penetration test sampler
 c Cuttings
 ▽ Elevation of ground water

FILE: FMC MW Log Form pg 2.ai 1004931.010604 04/03/2007 SLC

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
5											Time
6											
7											
8										Pushed Shelby Tube 6-8'	931
9											
10											
11										silt (ML) yellowish brown (10YR5/4) dry, low plasticity, soft.	
12											940
13											
14											
15											

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DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
15	0	15	10		6	C	↑	ML		silt (ML) yellowish brown (10YR 5/4) dry to slightly moist, slightly plastic, medium stiff.	Time
16					8						949
17					8						
18											
19											
20					8	C	↑				
21					10			ML		ML as above @ 15'	
22	60	30	10		20			GP		fine to medium sandy fine to coarse gravel (GP), Pale Brown (10YR 6/3) NP, dry, medium dense. Fine to medium grained gtzite subrounded gravel.	959
23											
24											
25											

[illegible]



BORING LOCATION

Project: Data Gap Project No: 10503311Boring ID: FMC-SB-7Date Drilled: 11/13/13 Date Completed: 11/13/13Northing: 448295.4 Easting: 547160.5Logged By: Bill BragdonGround Surface Elevation (ft.): 4452.9Water Elevation (ft.): NADatum: NGVD (1988)Date Measured: NATotal Depth (ft.): 30'Drilling Contractor: Cenotec/JefferDiameter (in.): 8"Drilling Method: HSAAbandonment Information: Back-filled with Soil Cuttings

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICATION	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
0	0	15	100			GRAB		ML		Silt (ML) pale brown (10YR 6/3) slightly to low plasticity, medium stiff, dry.	Time 1103
1								ML			
2								ML			
3						Shelby Tube		ML			
4								ML		Pushed Shelby Tube 2-4'	1115
5											

- * C California Split Spoon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

PAGE 1 OF 4

DEPTH (FEET)	GRAIN SIZE			MAX. P/D	READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES									
5												Time
6												
7												
8							Shelby Tube		ML		Pushed Shelby Tube 6'-8'	1140
9												
10	15	10			4				ML		Silt (ML) very pale brown (10R 7/3) dry, low to slightly plastic	1140
11					5						soft to medium stiff.	1142
12					7							
13												
14											Pushed Shelby Tube 12'-14'	1202
15												

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FILE: FMC MW Log Form pg 3.ai 1004931.010604 04/03/2007 SLC

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
15	0	60	40		5	C		SM		Silty fine to coarse sand (SM) Pale brown (10YR 6/4), dry	Time
16					7					Non plastic to slightly plastic where silty.	1209
17					6						
18											
19											
20	0	5	100		7	C		ML		Silt (ML) pale brown (10YR 6/4) dry, low to slightly plastic medium	
21					8					Stiff to stiff.	1216
22					12						
23											
24											
25										Harder drilling. Estimated top of Gravel.	

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
25	60	40	15		38	c		GP		fine to coarse sandy fine & coarse gravel (GP) light gray (10YR 6/2)	Time
26					22					non plastic, dry, medium dense to dense, subrounded.	1226
27					21						
28											
29											
30	60	30	10		14	c		GP		fine to coarse sandy fine & coarse gravel (GP) w/ some silt, few cobbles	
					18					generally light gray (10YR 6/2) to yellowish brown (10YR 5/4)	
					21					dry, medium dense, subrounded gravel	1237
										TD w/ HSA 30' TD w/ sampler 31.5'	
										Back filled w/ soil from boring.	

BORING LOCATION	Project: <u>Data Gap</u> Project No: <u>10503311</u>	Boring ID: <u>FMC-SB-0</u>
	Date Drilled: <u>11/13/13</u> Date Completed: <u>11/13/13</u>	Northing: <u>449010.0</u> Easting: <u>54194.5</u>
	Logged By: <u>Bill Bradford</u>	Ground Surface Elevation (ft.): <u>4451.7</u>
	Water Elevation (ft.): <u>NA</u>	Datum: <u>NGVD (1988)</u>
	Date Measured: <u>NA</u>	
Total Depth (ft.): <u>30'</u>	Drilling Contractor: <u>Canotec / Jeff</u>	
Diameter (in.): <u>8"</u>	Drilling Method: <u>HSA</u>	
Abandonment Information: <u>Back filled with soil cuttings.</u>		

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICATION	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
0	0	100	0			GRAB		ML		Silt (ML) pale brown (10YR 6/3) to yellowish brown (10YR 5/4), slightly moist, slightly to low plasticity.	Time 1305
1										medium stiff, few roots & organics	
2								ML			1318
3											
4								ML		Pushed Shelby Tube 2'-4'	1325
5											

* C California Split Spoon Sampler (2.5" I.D.)
 S Standard penetration test sampler
 c Cuttings
 ▽ Elevation of ground water

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
5											Time
6								ML			
7											
8								ML		Pushed Shelby Tube 6'-8'	1334
9											
10								ML		Silt (ML) pale brown (10YR 4/3) dry, low to slightly plastic	
11					7					medium stiff to stiff	1343
12					9						
13											
14											
15											

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FILE: FMC MW Log Form pg 3.ai 1004931.010604 04/03/2007 SLC

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
15	0	25	100		4	C	A	ML		Silt (ML) pale brown (10YR 6/3) low to slightly plastic, dry, soft to medium stiff	Time
16					6						1351
17					8						
18											
19											
20	0	25	100		8	C	A	ML		Silt (ML) pale brown (10YR 6/3) low to slightly plasticity, dry, medium stiff.	1400
21					7						
22					9						
23											
24											
25											

DEPTH (FEET)	GRAIN SIZE			MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)
	% GRAVEL	% SAND	% FINES								
25	0	15	100		8	C	↑	ML		Silt (ML) pale brown (10YR 6/3) to moderate yellowish brown (10YR 5/4) dry, slightly to low plasticity medium stiff to stiff	Time
26					9						1417
27					15						
28											
29											
30	0	15	100		8	C	↑	ML		Silt (ML) moderate yellowish brown (10YR 5/4) dry, low to slightly plastic, medium stiff to stiff.	
					13						
					22			GP		Gravel caught in shoe, very hard the last 3" of run	1440
										IDW/ HSK 30' w/ SPT 31.5'	
										Backfilled with soil cuttings from boring	

FILE: FMC MW Log Form pg 3.ai 1004931.010604 04/03/2007 SLC



APPENDIX D

Geotechnical and Hydrological Testing Reports

Water Content and Unit Weight of Soil

(In General Accordance with ASTM D7263 Method B and D2216)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/27/2013**

By: **JDF**

Sample Info.	Boring No.	SB8	SB8	SB3	SB4	SB4	SB6	SB6	SB7
	Sample:								
	Depth:	2-4'	6-8'	0-2'	2-4'	6-8'	2-4'	6-8'	2-4'
Unit Weight Info.	Sample height, H (in)	4.427	4.492	4.663	4.000	6.051	4.409	5.159	4.921
	Sample diameter, D (in)	2.885	2.882	2.883	2.884	2.884	2.882	2.882	2.883
	Sample volume, V (ft ³)	0.0167	0.0170	0.0176	0.0151	0.0229	0.0166	0.0195	0.0186
	Mass rings + wet soil (g)	1721.56	1721.15	1848.02	1801.18	2045.31	1763.78	1151.00	1797.87
	Mass rings/tare (g)	1068.76	1075.67	1087.08	1244.25	1186.90	1067.18	361.78	1111.81
	Moist soil, Ws (g)	652.80	645.48	760.94	556.93	858.41	696.60	789.22	686.06
	Moist unit wt., γ_m (pcf)	85.93	83.92	95.23	81.20	82.73	92.27	89.34	81.36
Water Content	Wet soil + tare (g)	768.44	738.89	477.75	661.30	430.10	524.88	587.23	354.56
	Dry soil + tare (g)	718.97	690.41	461.22	636.71	413.13	472.91	547.48	324.20
	Tare (g)	126.82	124.36	124.42	124.41	128.35	127.69	123.36	128.51
Water Content, w (%)		8.4	8.6	4.9	4.8	6.0	15.1	9.4	15.5
Dry Unit Wt., γ_d (pcf)		79.3	77.3	90.8	77.5	78.1	80.2	81.7	70.4

Entered by: _____

Reviewed: _____

Water Content and Unit Weight of Soil

(In General Accordance with ASTM D7263 Method B and D2216)



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Project: MWH**No: 00303-014****Location: FMC RDRA Data Gap Investigation****Date: 12/16/2013****By: JDF**

Sample Info.	Boring No.	SB7	SB7						
	Sample:								
	Depth:	6-8'	12-14'						
Unit Weight Info.	Sample height, H (in)	2.770	4.443						
	Sample diameter, D (in)	2.884	2.798						
	Sample volume, V (ft ³)	0.0105	0.0158						
	Mass rings + wet soil (g)	628.36	800.26						
	Mass rings/tare (g)	152.04	168.60						
	Moist soil, Ws (g)	476.32	631.66						
	Moist unit wt., γ_m (pcf)	100.28	88.08						
Water Content	Wet soil + tare (g)	296.80	754.94						
	Dry soil + tare (g)	287.40	738.11						
	Tare (g)	128.47	223.39						
Water Content, w (%)		5.9	3.3						
Dry Unit Wt., γ_d (pcf)		94.7	85.3						

Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/12/2013**

By: **BRR**

Boring No.: **WUA-TP001-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Preparation method: **Air Dry**

Liquid limit test method: **Multipoint**

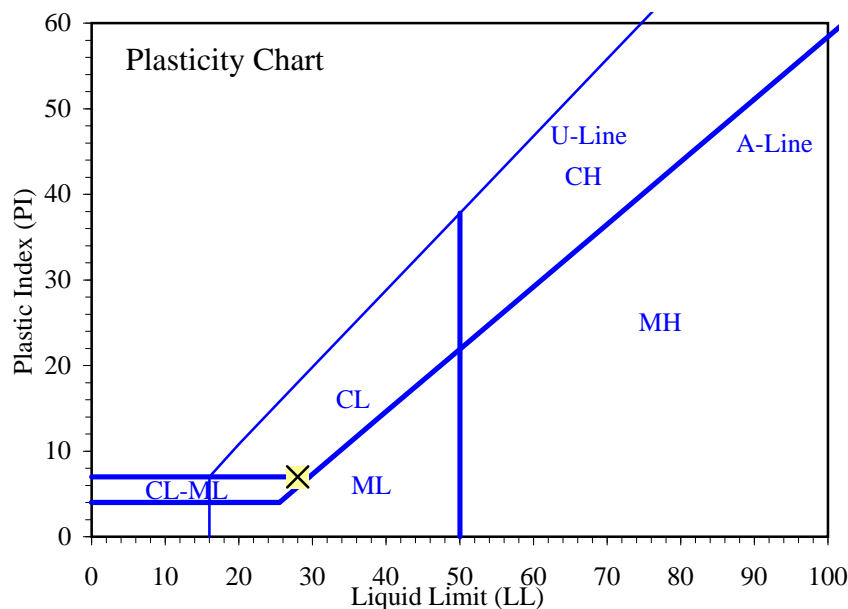
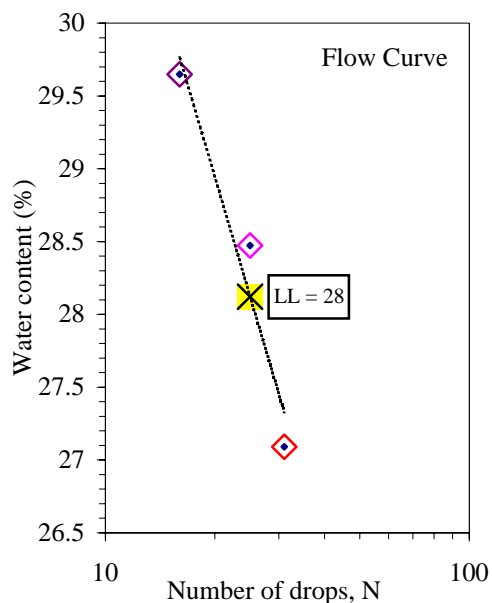
Plastic Limit

Determination No	1	2				
Wet Soil + Tare (g)	31.64	32.88				
Dry Soil + Tare (g)	30.00	31.03				
Water Loss (g)	1.64	1.85				
Tare (g)	22.14	22.07				
Dry Soil (g)	7.86	8.96				
Water Content, w (%)	20.87	20.65				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	31	25	16			
Wet Soil + Tare (g)	31.38	30.95	32.16			
Dry Soil + Tare (g)	29.34	28.88	29.88			
Water Loss (g)	2.04	2.07	2.28			
Tare (g)	21.81	21.61	22.19			
Dry Soil (g)	7.53	7.27	7.69			
Water Content, w (%)	27.09	28.47	29.65			
One-Point LL (%)		28				

Liquid Limit, LL (%)	28
Plastic Limit, PL (%)	21
Plasticity Index, PI (%)	7



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/12/2013**

By: **BRR**

Boring No.: **WUA-TP002-01**

Sample:

Depth: **1-10'**

Description: **Brown lean clay**

Preparation method: **Air Dry**

Liquid limit test method: **Multipoint**

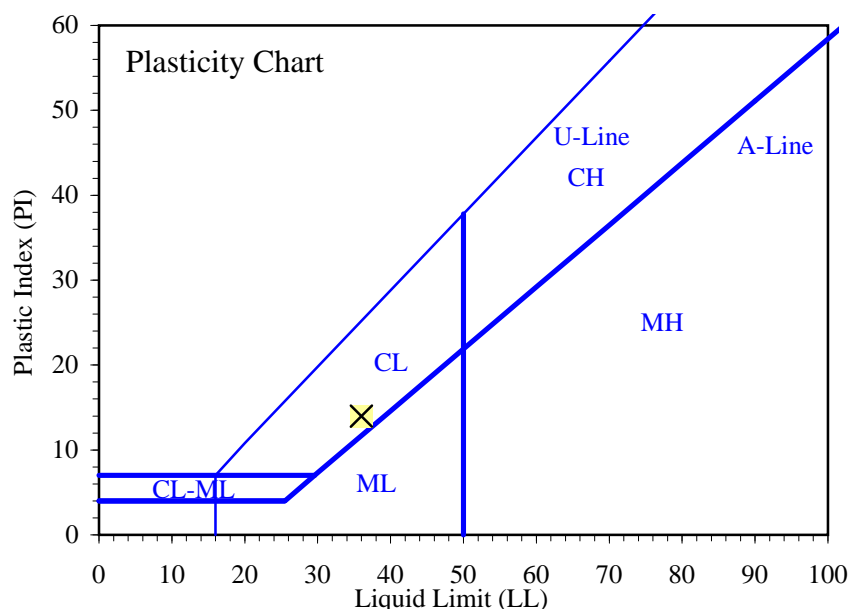
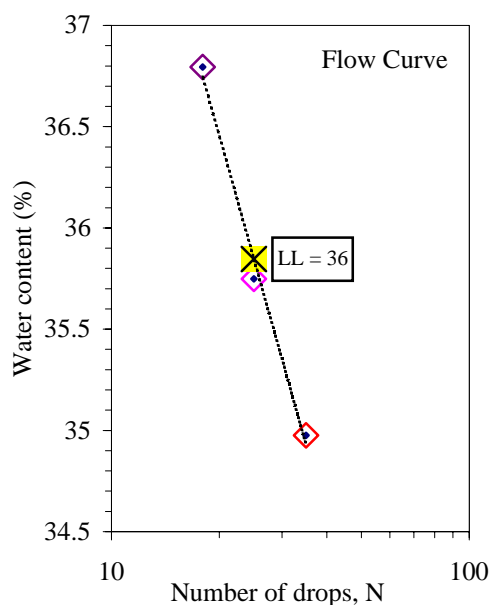
Plastic Limit

Determination No	1	2				
Wet Soil + Tare (g)	30.52	29.74				
Dry Soil + Tare (g)	29.02	28.38				
Water Loss (g)	1.50	1.36				
Tare (g)	22.04	22.12				
Dry Soil (g)	6.98	6.26				
Water Content, w (%)	21.49	21.73				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	25	18			
Wet Soil + Tare (g)	30.40	30.70	30.85			
Dry Soil + Tare (g)	28.20	28.43	28.37			
Water Loss (g)	2.20	2.27	2.48			
Tare (g)	21.91	22.08	21.63			
Dry Soil (g)	6.29	6.35	6.74			
Water Content, w (%)	34.98	35.75	36.80			
One-Point LL (%)		36				

Liquid Limit, LL (%)	36
Plastic Limit, PL (%)	22
Plasticity Index, PI (%)	14



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



© IGES 2004, 2013

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/12/2013**

By: **BRR**

Boring No.: **WUA-TP003-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Preparation method: **Air Dry**

Liquid limit test method: **Multipoint**

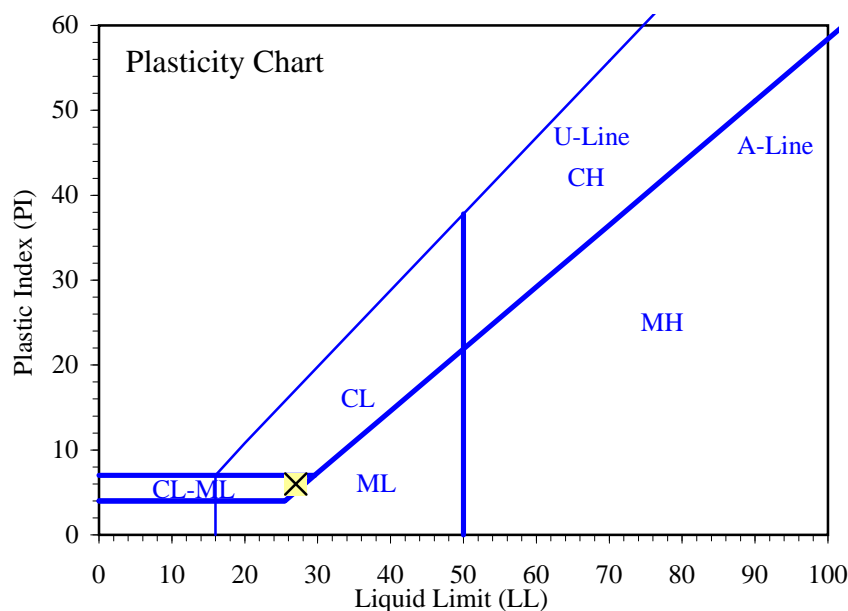
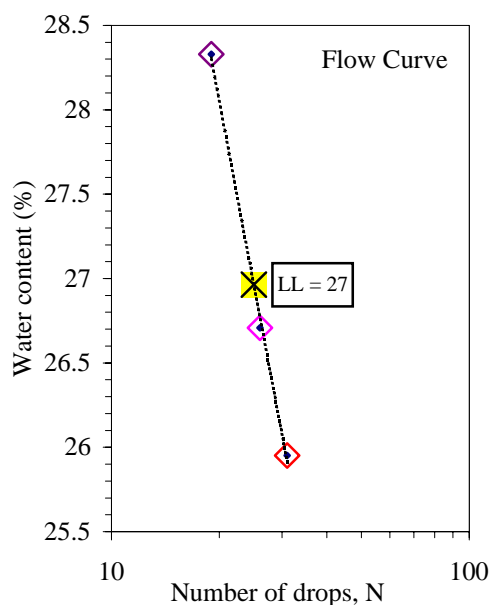
Plastic Limit

Determination No	1	2				
Wet Soil + Tare (g)	30.10	32.41				
Dry Soil + Tare (g)	28.69	30.62				
Water Loss (g)	1.41	1.79				
Tare (g)	22.05	22.08				
Dry Soil (g)	6.64	8.54				
Water Content, w (%)	21.23	20.96				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	31	26	19			
Wet Soil + Tare (g)	30.69	30.15	30.75			
Dry Soil + Tare (g)	28.85	28.43	28.75			
Water Loss (g)	1.84	1.72	2.00			
Tare (g)	21.76	21.99	21.69			
Dry Soil (g)	7.09	6.44	7.06			
Water Content, w (%)	25.95	26.71	28.33			
One-Point LL (%)		27				

Liquid Limit, LL (%)	27
Plastic Limit, PL (%)	21
Plasticity Index, PI (%)	6



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



© IGES 2004, 2013

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/14/2013**

By: **BRR**

Boring No.: **WUA-TP004-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Preparation method: **Air Dry**

Liquid Limit: **Could not be determined (N.P.)**

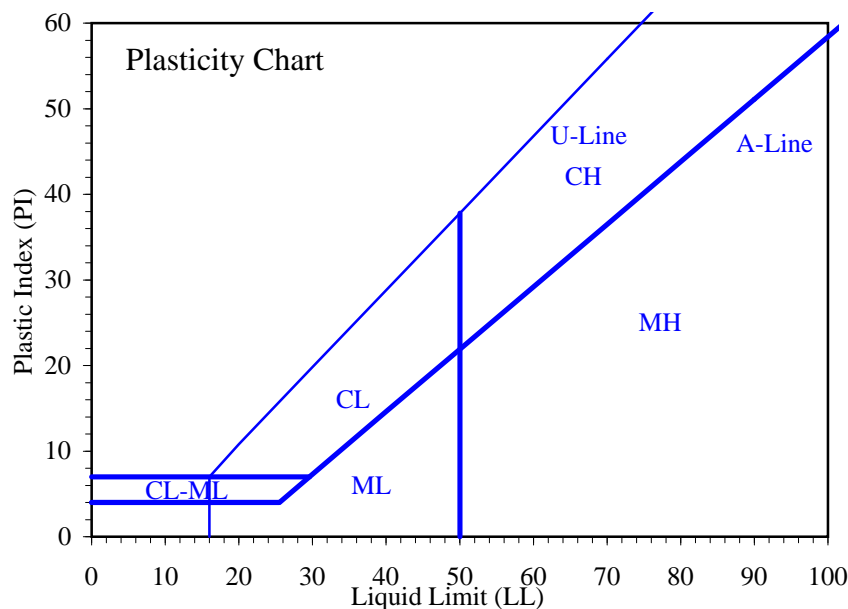
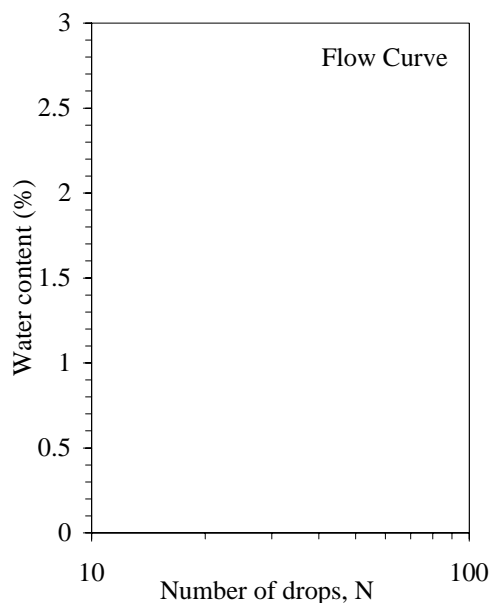
Plastic Limit

Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)		Unable to obtain an adequate blow count.				
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	Nonplastic (N.P.)
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/14/2013**

By: **BRR**

Boring No.: **WUA-TP005-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Preparation method: **Air Dry**

Liquid limit test method: **Multipoint**

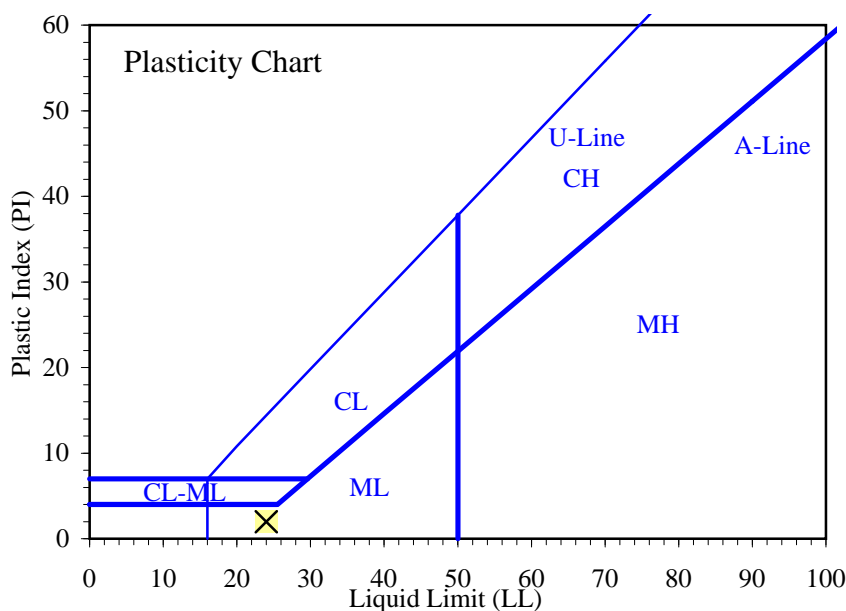
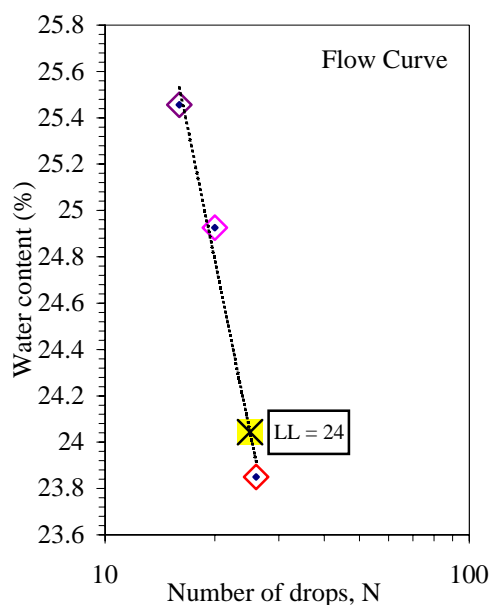
Plastic Limit

Determination No	1	2				
Wet Soil + Tare (g)	29.97	33.78				
Dry Soil + Tare (g)	28.49	31.70				
Water Loss (g)	1.48	2.08				
Tare (g)	21.64	22.04				
Dry Soil (g)	6.85	9.66				
Water Content, w (%)	21.61	21.53				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	26	20	16			
Wet Soil + Tare (g)	33.17	30.30	33.04			
Dry Soil + Tare (g)	30.89	28.62	30.81			
Water Loss (g)	2.28	1.68	2.23			
Tare (g)	21.33	21.88	22.05			
Dry Soil (g)	9.56	6.74	8.76			
Water Content, w (%)	23.85	24.93	25.46			
One-Point LL (%)	24	24				

Liquid Limit, LL (%)	24
Plastic Limit, PL (%)	22
Plasticity Index, PI (%)	2



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/14/2013**

By: **BRR**

Boring No.: **WUA-TP006-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Preparation method: **Air Dry**

Liquid limit test method: **Multipoint**

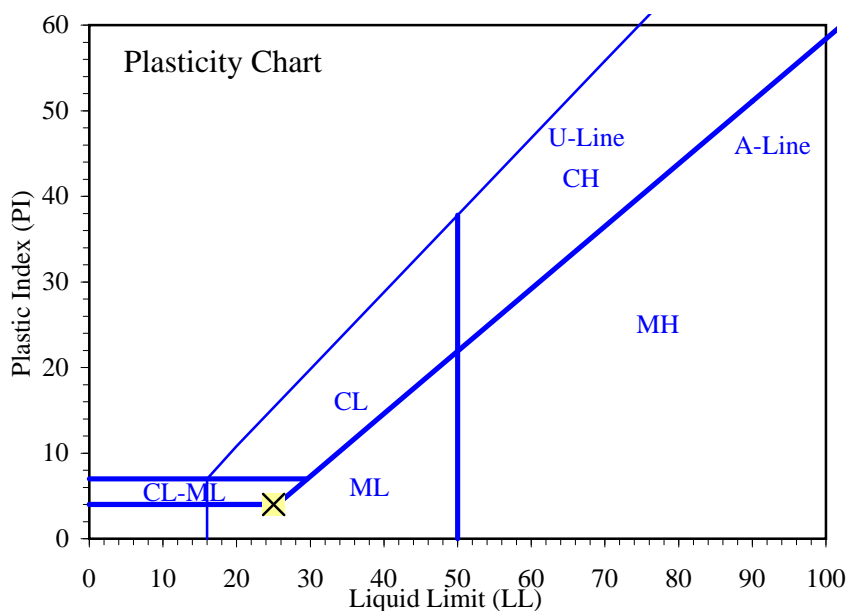
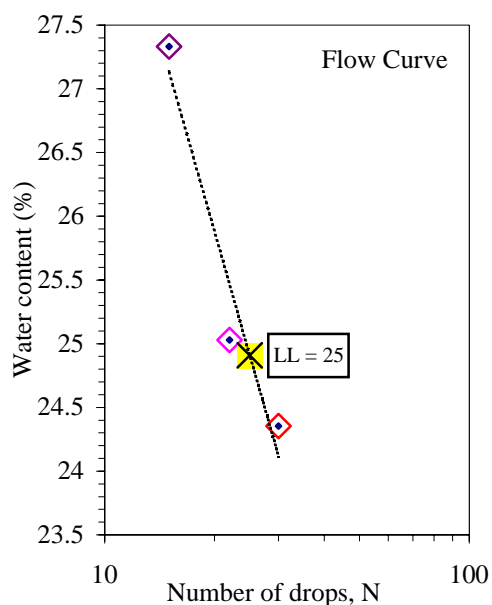
Plastic Limit

Determination No	1	2				
Wet Soil + Tare (g)	31.07	31.18				
Dry Soil + Tare (g)	29.41	29.55				
Water Loss (g)	1.66	1.63				
Tare (g)	21.70	21.80				
Dry Soil (g)	7.71	7.75				
Water Content, w (%)	21.53	21.03				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	30	22	15			
Wet Soil + Tare (g)	32.11	32.92	31.87			
Dry Soil + Tare (g)	30.13	30.69	29.76			
Water Loss (g)	1.98	2.23	2.11			
Tare (g)	22.00	21.78	22.04			
Dry Soil (g)	8.13	8.91	7.72			
Water Content, w (%)	24.35	25.03	27.33			
One-Point LL (%)	25	25				

Liquid Limit, LL (%)	25
Plastic Limit, PL (%)	21
Plasticity Index, PI (%)	4



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/12/2013**

By: **BRR**

Boring No.: **WUA-TP007-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Preparation method: **Air Dry**

Liquid limit test method: **Multipoint**

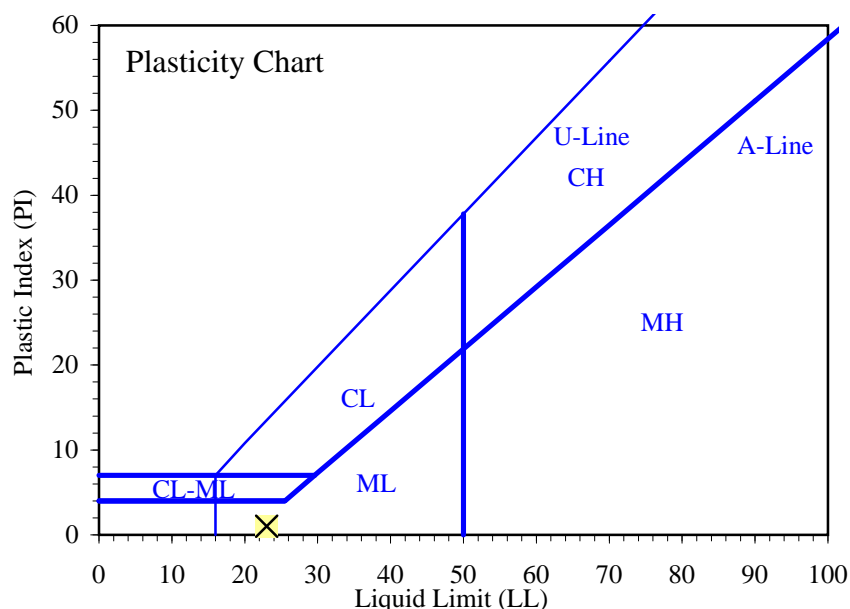
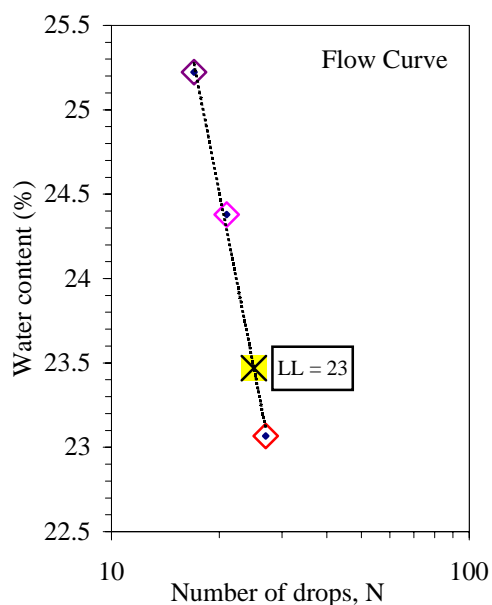
Plastic Limit

Determination No	1	2				
Wet Soil + Tare (g)	29.81	30.38				
Dry Soil + Tare (g)	28.31	28.86				
Water Loss (g)	1.50	1.52				
Tare (g)	21.57	21.95				
Dry Soil (g)	6.74	6.91				
Water Content, w (%)	22.26	22.00				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	27	21	17			
Wet Soil + Tare (g)	31.03	30.86	31.60			
Dry Soil + Tare (g)	29.30	29.09	29.62			
Water Loss (g)	1.73	1.77	1.98			
Tare (g)	21.80	21.83	21.77			
Dry Soil (g)	7.50	7.26	7.85			
Water Content, w (%)	23.07	24.38	25.22			
One-Point LL (%)	23	24				

Liquid Limit, LL (%)	23
Plastic Limit, PL (%)	22
Plasticity Index, PI (%)	1



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/12/2013**

By: **BRR**

Boring No.: **WUA-TP008-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Preparation method: **Air Dry**

Liquid limit test method: **Multipoint**

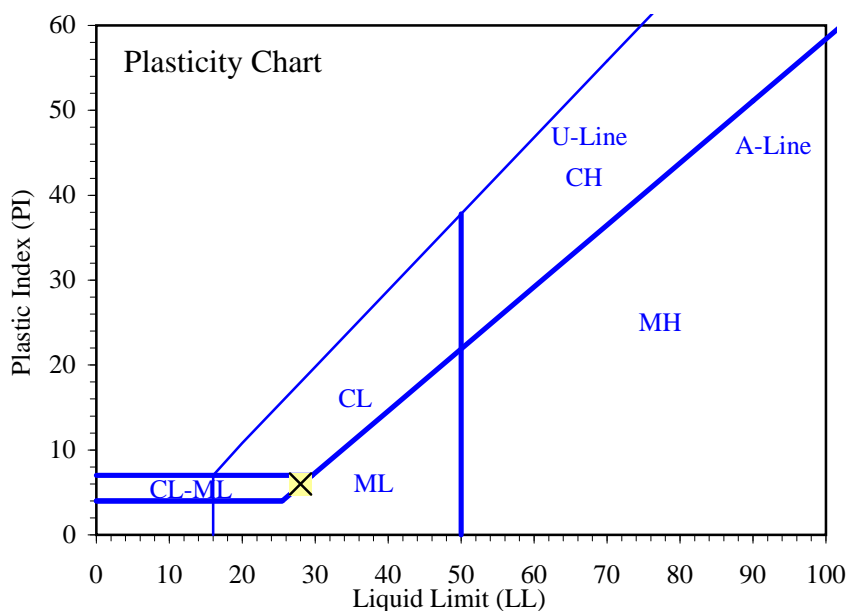
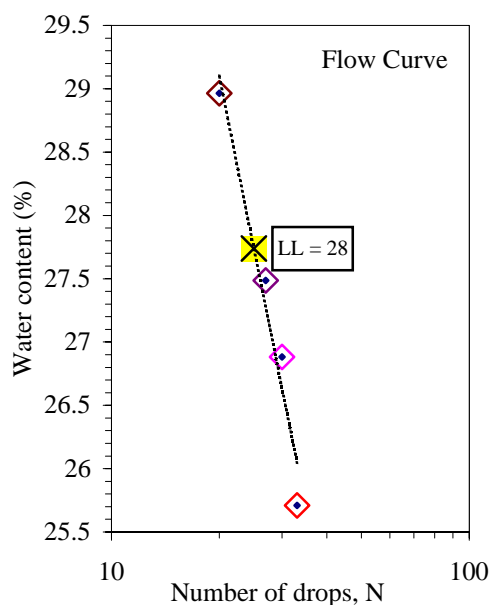
Plastic Limit

Determination No	1	2				
Wet Soil + Tare (g)	32.87	34.54				
Dry Soil + Tare (g)	30.87	32.20				
Water Loss (g)	2.00	2.34				
Tare (g)	21.88	21.71				
Dry Soil (g)	8.99	10.49				
Water Content, w (%)	22.25	22.31				

Liquid Limit

Determination No	1	2	3	4		
Number of Drops, N	33	30	27	20		
Wet Soil + Tare (g)	29.73	31.35	31.06	31.18		
Dry Soil + Tare (g)	28.10	29.35	29.07	29.08		
Water Loss (g)	1.63	2.00	1.99	2.10		
Tare (g)	21.76	21.91	21.83	21.83		
Dry Soil (g)	6.34	7.44	7.24	7.25		
Water Content, w (%)	25.71	26.88	27.49	28.97		
One-Point LL (%)		27	28	28		

Liquid Limit, LL (%)	28
Plastic Limit, PL (%)	22
Plasticity Index, PI (%)	6



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/12/2013**

By: **BRR**

Boring No.: **WUA-TP009-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Preparation method: **Air Dry**

Liquid limit test method: **Multipoint**

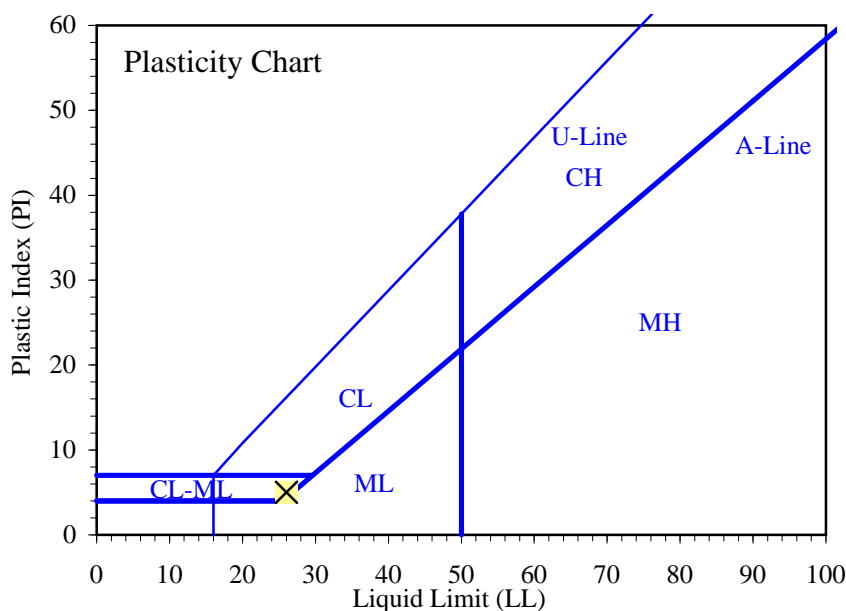
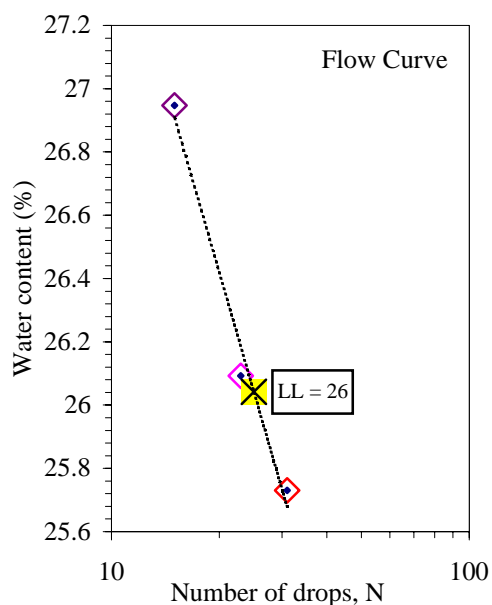
Plastic Limit

Determination No	1	2				
Wet Soil + Tare (g)	31.58	32.40				
Dry Soil + Tare (g)	29.88	30.55				
Water Loss (g)	1.70	1.85				
Tare (g)	21.85	21.71				
Dry Soil (g)	8.03	8.84				
Water Content, w (%)	21.17	20.93				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	31	23	15			
Wet Soil + Tare (g)	30.83	31.90	32.25			
Dry Soil + Tare (g)	28.98	29.81	30.07			
Water Loss (g)	1.85	2.09	2.18			
Tare (g)	21.79	21.80	21.98			
Dry Soil (g)	7.19	8.01	8.09			
Water Content, w (%)	25.73	26.09	26.95			
One-Point LL (%)		26				

Liquid Limit, LL (%)	26
Plastic Limit, PL (%)	21
Plasticity Index, PI (%)	5



Entered by: _____

Reviewed: _____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/14/2013**

By: **BRR**

Boring No.: **WUA-TP010-001**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Preparation method: **Air Dry**

Liquid Limit: **Could not be determined (N.P.)**

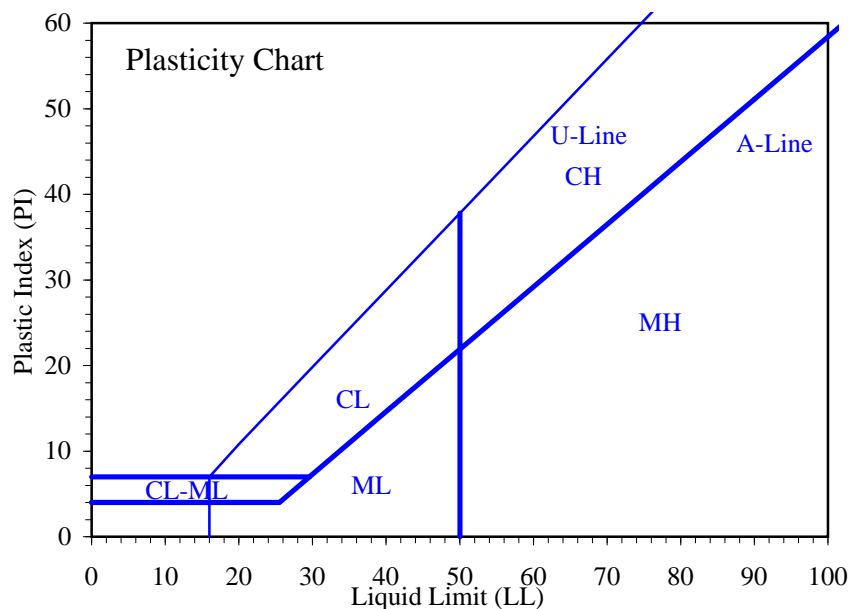
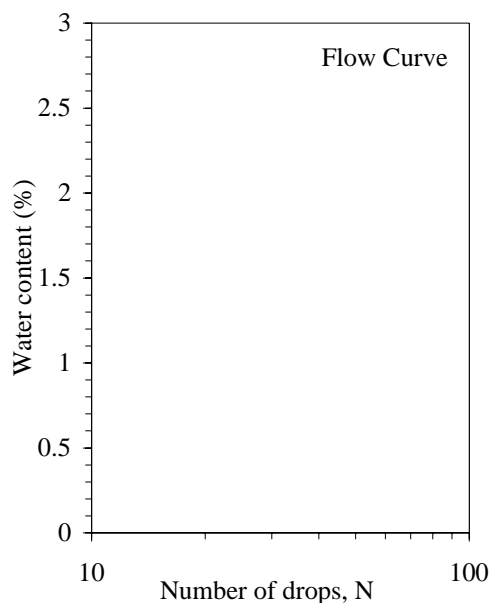
Plastic Limit

Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)		Unable to obtain an adequate blow count.				
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	Nonplastic (N.P.)
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	



Entered by: _____

Reviewed: _____

Dispersive Characteristics of Clay Soil by Double Hydrometer
(ASTM D 4221)

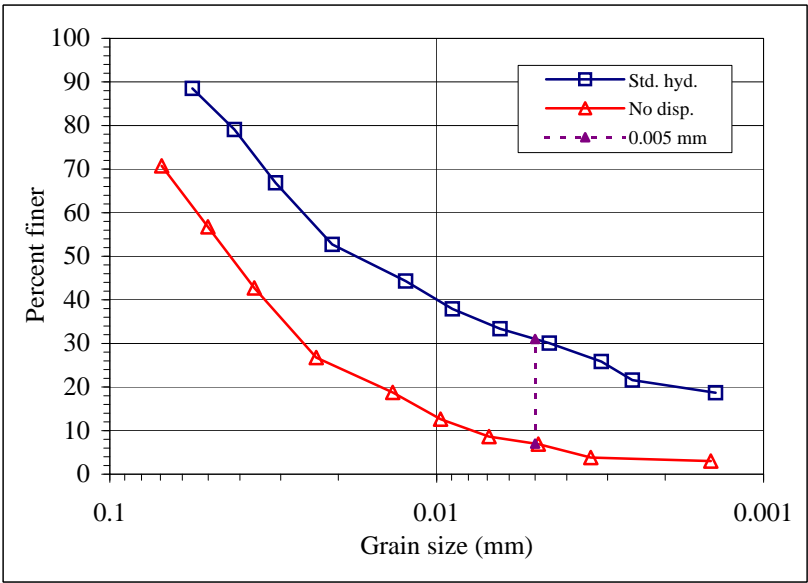


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Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

Boring No.: WUA-TP001-01
Sample:
Depth: 1-10'
Description: Brown silty clay

Percent passing 5 um (ASTM D 4221) =		7.00	
Percent passing 5 um (ASTM D 422) =		31.02	
Percent Dispersion =		22.5	
Standard Hyd. (ASTM D 422)		Double Hyd. (ASTM D 4221)	
I	J	I	J
Particle size (mm)	Percent finer	Particle size (mm)	Percent finer
0.0559	88.5	0.0694	70.7
0.0415	79.1	0.0501	56.7
0.0311	66.9	0.0361	42.7
0.0209	52.7	0.0234	26.7
0.0124	44.3	0.0136	18.7
0.0090	37.9	0.0097	12.6
0.0064	33.4	0.0069	8.6
0.0045	30.1	0.0049	6.9
0.0031	25.9	0.0034	3.8
0.0025	21.6	0.0014	3.0
0.0014	18.7		



Entered by: _____
Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

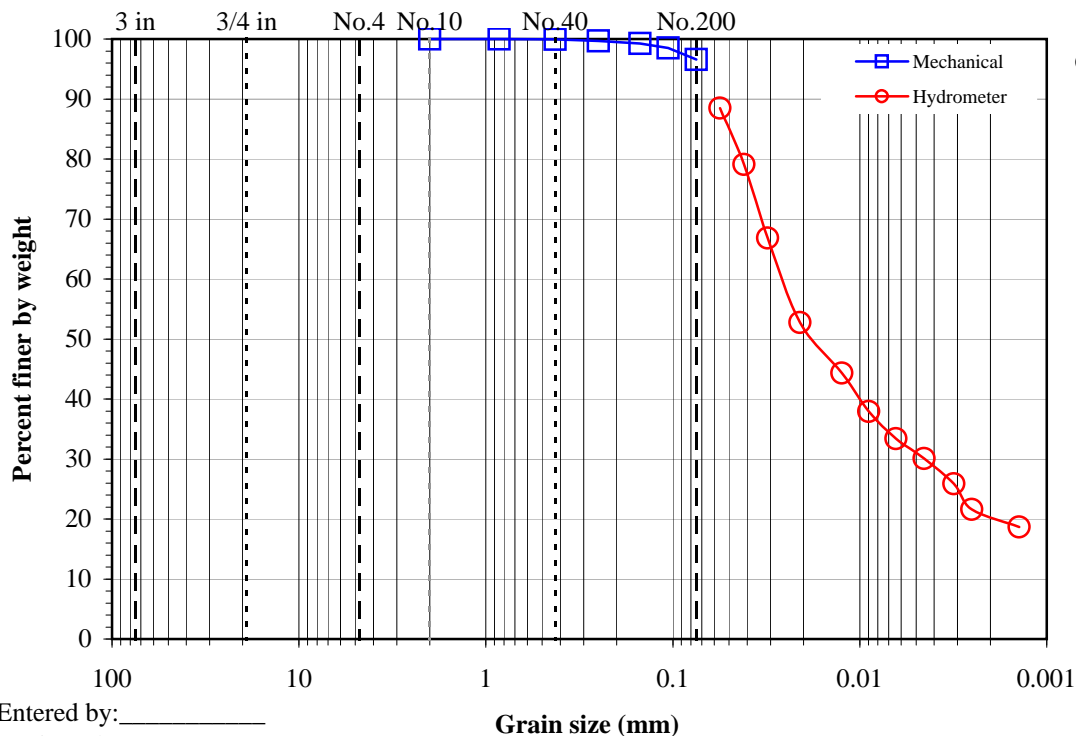
Boring No.: **WUA-TP001-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 54.59 53.11 + #10 Coarse fraction (g): 0.00 - #10 Split fraction (g): 54.59 53.11 Hydrometer fraction (g): 54.59 53.11 Split fraction: 1.000				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(-No.10)					
				Moist soil + tare (g):		-	92.41	92.41	
				Dry soil + tare (g):		-	90.93	90.93	
				Tare (g):		-	37.69	37.69	
				Water content (%):		0.00	2.78	2.78	
				<u>Hydrometer data</u>					



Gravel (%): 0.0
 Sand (%): 3.4
 Fines (%): 96.6

Entered by: _____

Reviewed: _____

Grain size (mm)

Particle-Size Analysis of Soils with hydrometer

(ASTM D4221)



© IGES 2004, 2013

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

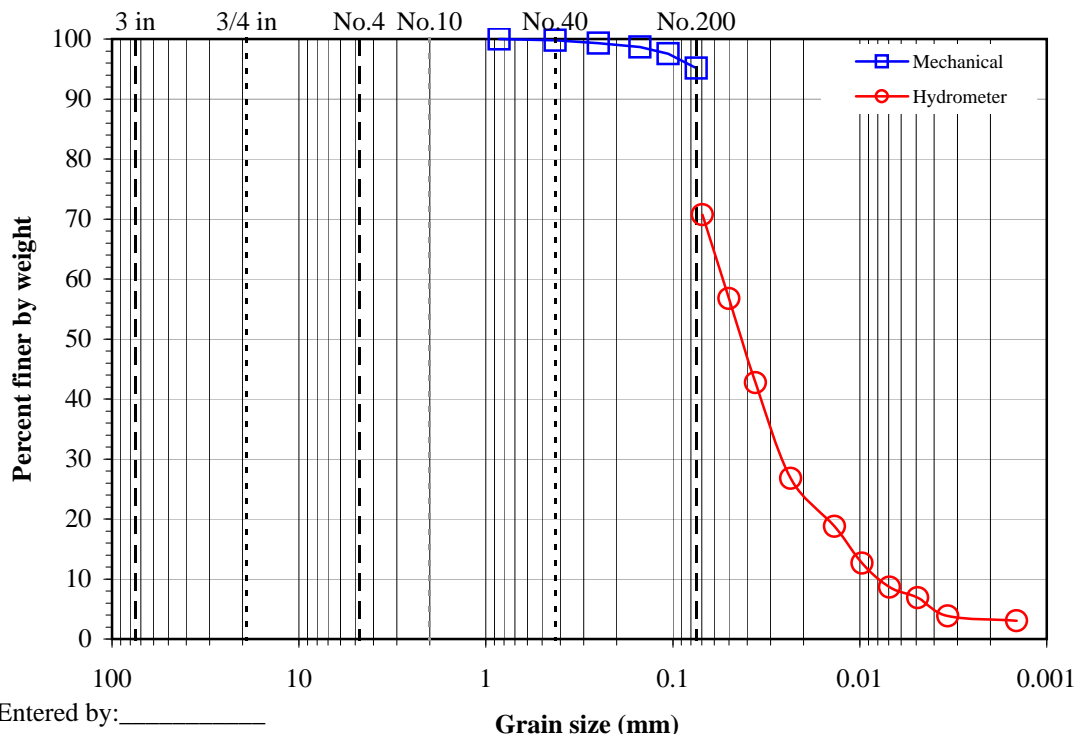
Boring No.: **WUA-TP001-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 25.70 25.00 + #10 Coarse fraction (g): 0.00 - #10 Split fraction (g): 25.70 25.00 Hydrometer fraction (g): 25.70 25.00 Split fraction: 1.000				Water content data C.F.(+ #10) S.F.(- #10) Hyd.(-No.10)					
				Moist soil + tare (g):		-	92.41	92.41	
				Dry soil + tare (g):		-	90.93	90.93	
				Tare (g):		-	37.69	37.69	
				Water content (%):		0.00	2.78	2.78	
				Hydrometer data					
				Hyd. split:		No.10	Intercept: 16.3		
				Gs:		2.65	Assumed	α: 1.00	
				Bulb No.		2	Hyd. fraction: 100.00		
				Vacuum period (min):		10	Dispersion device: None		
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-		0.5	21.8	17	0.06941	70.74
6"	-	150	-		1	21.8	13.5	0.05011	56.74
4"	-	100	-		2	21.8	10	0.03615	42.74
3"	-	75	-		5	21.8	6	0.02337	26.75
1.5"	-	37.5	-		15	21.8	4	0.01364	18.75
3/4"	-	19	-		30	21.7	2.5	0.00973	12.62
3/8"	-	9.5	-		60	21.7	1.5	0.00692	8.62
No.4	-	4.75	-		120	21.9	1	0.00489	6.89
No.10	-	2	-		250	22.6	0	0.00338	3.82
No.20	-	0.85	100.0		1377	22	0	0.00145	3.02
No.40	0.06	0.425	99.8						
No.60	0.17	0.25	99.3						
No.100	0.34	0.15	98.6						
No.140	0.62	0.106	97.5						
No.200	1.21	0.075	95.2						



Gravel (%): 0.0

Sand (%): 4.8

Fines (%): 95.2

Comments:

Vacuum applied and no flocculating agent used.

Entered by: _____

Reviewed: _____

Dispersive Characteristics of Clay Soil by Double Hydrometer
(ASTM D 4221)

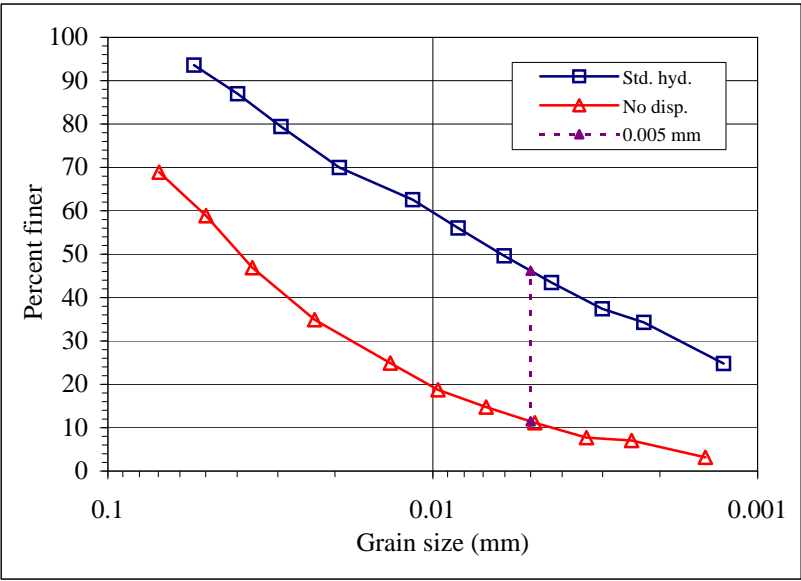


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Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

Boring No.: WUA-TP002-01
Sample:
Depth: 1-10'
Description: Brown clay

Percent passing 5 um (ASTM D 4221) =		11.46		
Percent passing 5 um (ASTM D 422) =		46.20		
Percent Dispersion =		24.8		
Standard Hyd. (ASTM D 422)			Double Hyd. (ASTM D 4221)	
I	J		I	J
Particle size	Percent		Particle size	Percent
(mm)	finer		(mm)	finer
0.0543	93.6		0.0695	68.9
0.0399	87.0		0.0499	58.9
0.0293	79.4		0.0359	46.9
0.0194	70.0		0.0231	34.9
0.0115	62.5		0.0135	24.9
0.0084	56.0		0.0096	18.8
0.0060	49.6		0.0069	14.8
0.0043	43.5		0.0049	11.2
0.0030	37.4		0.0034	7.7
0.0022	34.3		0.0024	7.0
0.0013	24.8		0.0014	3.2



Entered by: _____
Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

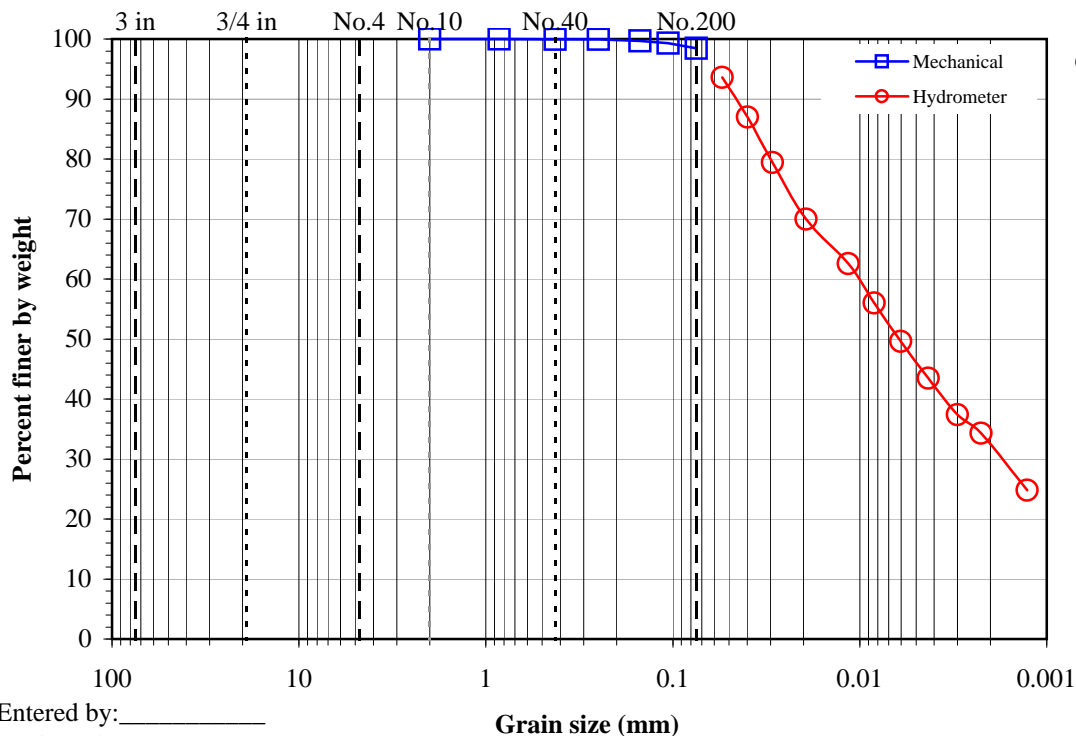
Boring No.: **WUA-TP002-01**

Sample:

Depth: **1-10'**

Description: **Brown clay**

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 54.81 52.95 + #10 Coarse fraction (g): 0.00 - #10 Split fraction (g): 54.81 52.95 Hydrometer fraction (g): 54.81 52.95 Split fraction: 1.000				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(-No.10)					
				Moist soil + tare (g): - 72.43 72.43					
				Dry soil + tare (g): - 71.25 71.25					
				Tare (g): - 37.74 37.74					
				Water content (%): 0.00 3.52 3.52					
				<u>Hydrometer data</u>					



Entered by: _____

Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D4221)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

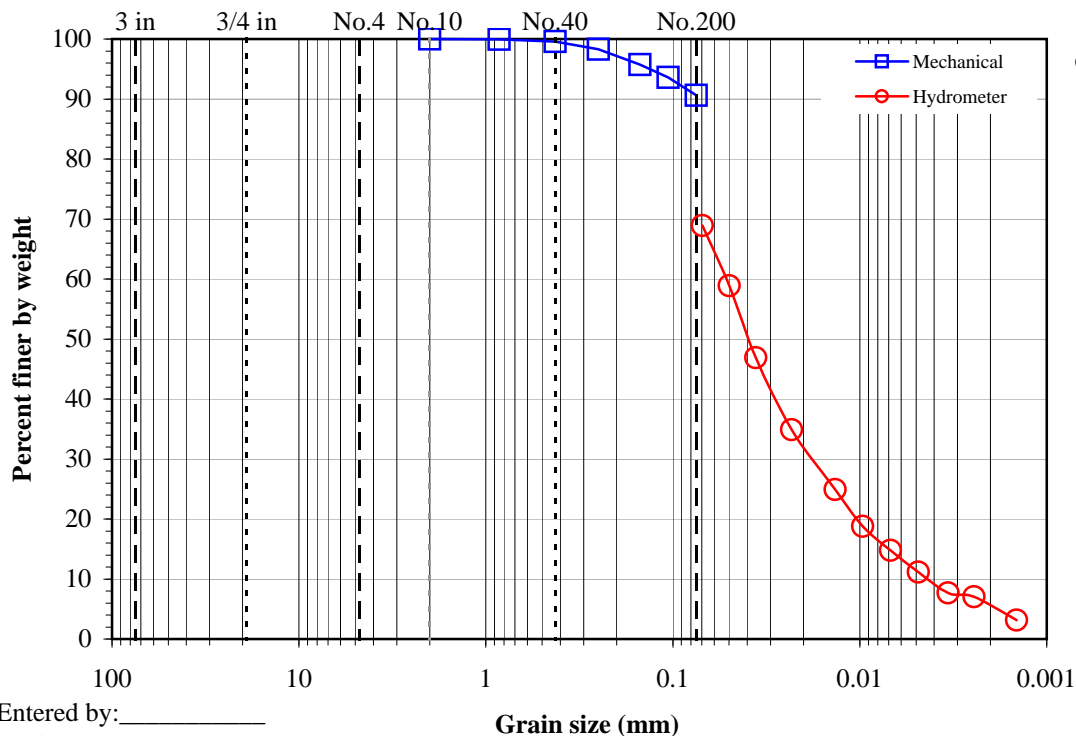
Boring No.: **WUA-TP002-01**

Sample:

Depth: **1-10'**

Description: **Brown clay**

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 25.88 25.00 +#10 Coarse fraction (g): 0.00 -#10 Split fraction (g): 25.88 25.00 Hydrometer fraction (g): 25.88 25.00 Split fraction: 1.000				Water content data C.F.(+#10) S.F.(-#10) Hyd.(-No.10)						
				Moist soil + tare (g):		-	72.43	72.43		
				Dry soil + tare (g):		-	71.25	71.25		
				Tare (g):		-	37.74	37.74		
				Water content (%):		0.00	3.52	3.52		
				Hydrometer data						
				Hyd. split:		No.10	Slope:		-0.1641	
				Intercept:		16.3				
				Gs:		2.65	Assumed	α:		1.00
				Bulb No.		2	Hyd. fraction:		100.00	
				Vacuum period (min):		10	Dispersion device:		None	
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension	
8"	-	200	-		0.5	21.9	16.5	0.06955	68.89	
6"	-	150	-		1	21.9	14	0.04991	58.89	
4"	-	100	-		2	21.9	11	0.03591	46.89	
3"	-	75	-		5	21.9	8	0.02309	34.89	
1.5"	-	37.5	-		15	21.9	5.5	0.01351	24.89	
3/4"	-	19	-		30	21.8	4	0.00964	18.75	
3/8"	-	9.5	-		60	21.8	3	0.00685	14.75	
No.4	-	4.75	-		120	22.1	2	0.00485	11.15	
No.10	-	2	100.0		250	22.5	1	0.00336	7.69	
No.20	0.01	0.85	100.0		465	23.5	0.5	0.00244	7.03	
No.40	0.10	0.425	99.6		1375	22.1	0	0.00145	3.15	
No.60	0.43	0.25	98.3							
No.100	1.06	0.15	95.8							
No.140	1.60	0.106	93.6							
No.200	2.34	0.075	90.6							



Gravel (%): 0.0
Sand (%): 9.4
Fines (%): 90.6

Comments:

Vacuum applied and no flocculating agent used.

Dispersive Characteristics of Clay Soil by Double Hydrometer
(ASTM D 4221)

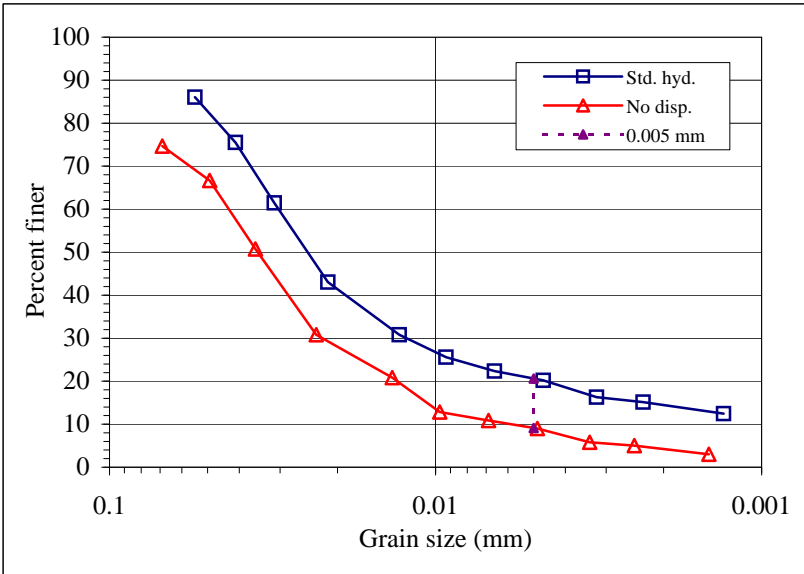


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Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

Boring No.: WUA-TP003-01
Sample:
Depth: 1-10'
Description: Brown silty clay

Percent passing 5 um (ASTM D 4221) = 9.13		Percent passing 5 um (ASTM D 422) = 20.62		Percent Dispersion = 44.3	
Standard Hyd. (ASTM D 422)			Double Hyd. (ASTM D 4221)		
I	J		I	J	
Particle size (mm)	Percent finer		Particle size (mm)	Percent finer	
0.0547	86.0		0.0689	74.7	
0.0411	75.5		0.0493	66.7	
0.0312	61.5		0.0357	50.7	
0.0214	43.0		0.0232	30.8	
0.0129	30.8		0.0136	20.8	
0.0093	25.6		0.0097	12.8	
0.0066	22.4		0.0069	10.9	
0.0047	20.2		0.0049	9.0	
0.0032	16.3		0.0034	5.8	
0.0023	15.1		0.0025	5.0	
0.0013	12.5		0.0015	3.0	



Entered by: _____
Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

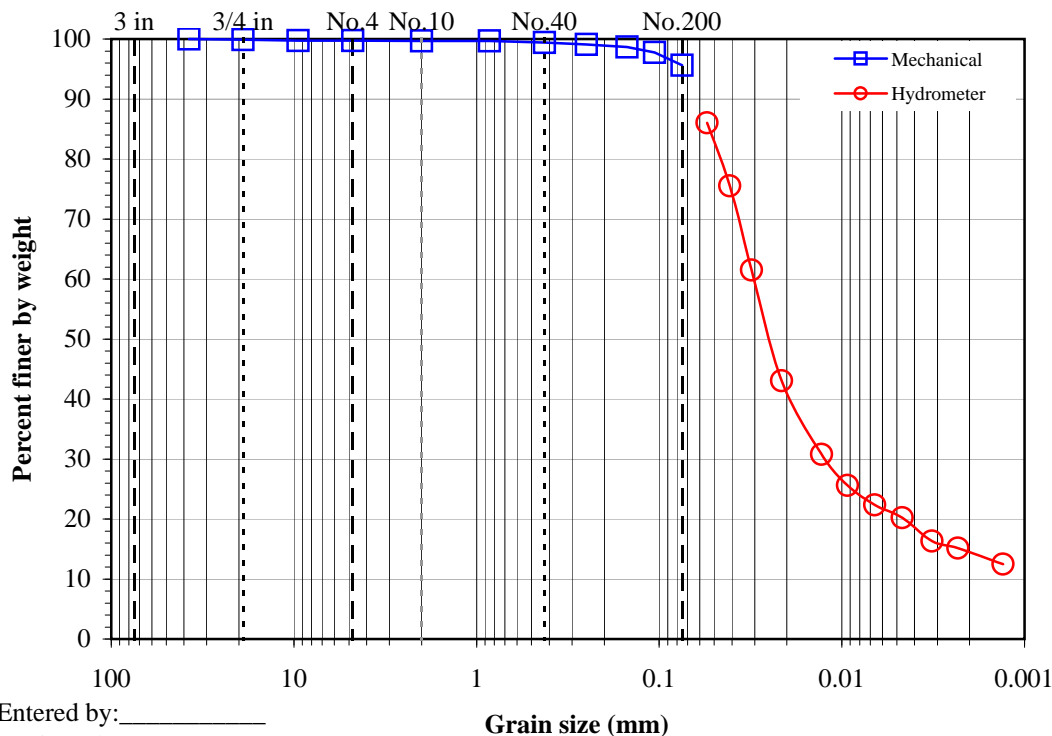
Boring No.: **WUA-TP003-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

<div>Split sieve: Yes</div> <div>Split sieve: 3/8"</div> <div>Moist Dry</div> <div>Total sample wt. (g): 18843.42 17743.34</div> <div>+3/8" Coarse fraction (g): 51.32 51.10</div> <div>-3/8" Split fraction (g): 463.00 463.00</div> <div>Hydrometer fraction (g): 57.65 56.82</div> <div>Split fraction: 0.997</div>				<div>Water content data C.F.(+3/8") S.F.(-3/8") Hyd.(+No.10) Hyd.(-No.10)</div> <div>Moist soil + tare (g): 178.88 626.37 37.82 72.08</div> <div>Dry soil + tare (g): 178.66 597.15 37.82 71.58</div> <div>Tare (g): 127.16 127.12 37.77 37.47</div> <div>Water content (%): 0.43 6.22 0.00 1.47</div>									
				<div>Hydrometer data</div> <div>Slope: -0.1641</div> <div>Hyd. split: No.10 Intercept: 16.3</div> <div>Gs: 2.65 Assumed α: 1.00</div> <div>Bulb No. 2 Hyd. fraction: 99.70</div> <div>Dispersion period (min): 15 Dispersion device: Air-jet</div>									
				Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<div><=Split</div> <div><=Split hyd.</div>	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
				8"	-	200	-		0.5	17.8	53	0.05471	86.04
				6"	-	150	-		1	17.8	47	0.04111	75.51
				4"	-	100	-		2	17.8	39	0.03122	61.47
				3"	-	75	-		5	17.8	28.5	0.02139	43.04
				1.5"	-	37.5	100.0		15	17.9	21.5	0.01293	30.80
3/4"	21.15	19	99.9	30	18.1	18.5	0.00929		25.61				
3/8"	51.10	9.5	99.7	60	18.8	16.5	0.00660		22.37				
No.4	-	4.75	99.7	118	20	15	0.00467	20.20					
No.10	0.05	2	99.7	250	21.3	12.5	0.00321	16.31					
No.20	0.02	0.85	99.7	470	22.8	11.5	0.00231	15.13					
No.40	0.15	0.425	99.4	1494	22.7	10	0.00131	12.46					
No.60	0.34	0.25	99.1										
No.100	0.60	0.15	98.6										
No.140	1.12	0.106	97.7										
No.200	2.32	0.075	95.6										



Gravel (%): 0.3
Sand (%): 4.1
Fines (%): 95.6

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

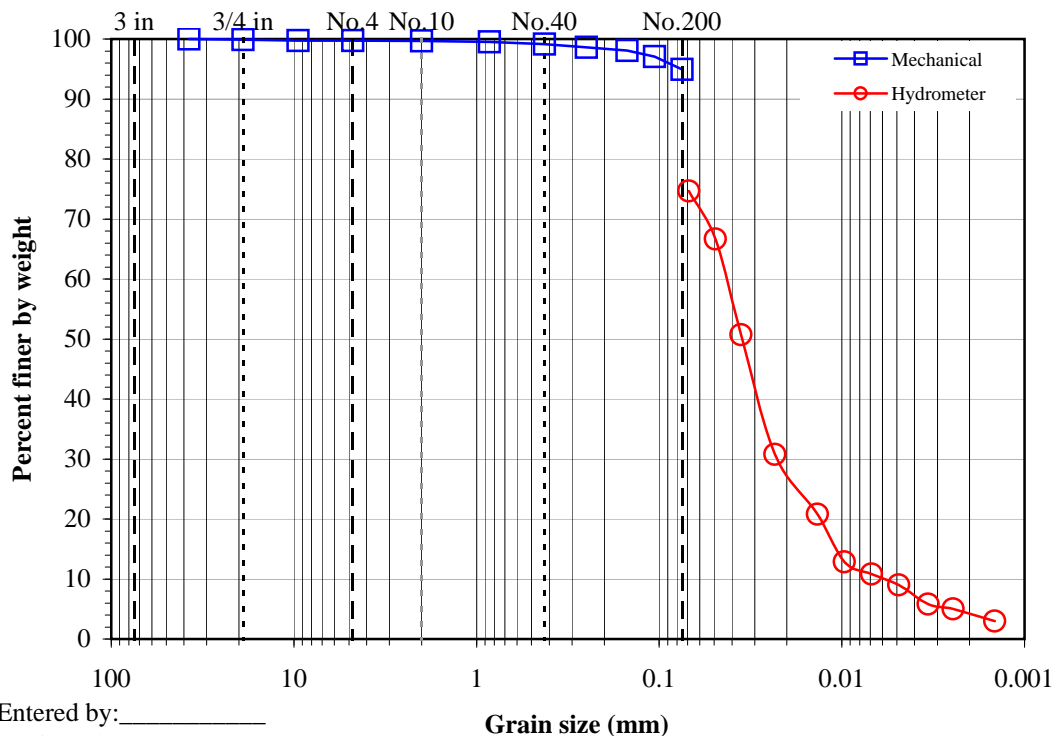
Boring No.: **WUA-TP003-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

<div>Split sieve: Yes</div> <div>Split sieve: 3/8"</div> <div>Moist Dry</div> <div>Total sample wt. (g): 18843.42 17743.34</div> <div>+3/8" Coarse fraction (g): 51.32 51.10</div> <div>-3/8" Split fraction (g): 463.00 463.00</div> <div>Hydrometer fraction (g): 25.37 25.00</div> <div>Split fraction: 0.997</div>				<div>Water content data C.F.(+3/8") S.F.(-3/8") Hyd.(+No.10) Hyd.(-No.10)</div> <div>Moist soil + tare (g): 178.88 626.37 37.82 72.08</div> <div>Dry soil + tare (g): 178.66 597.15 37.82 71.58</div> <div>Tare (g): 127.16 127.12 37.77 37.47</div> <div>Water content (%): 0.43 6.22 0.00 1.47</div>									
				<div>Hydrometer data Slope: -0.1641</div> <div>Hyd. split: No.10 Intercept: 16.3</div> <div>Gs: 2.65 Assumed α: 1.00</div> <div>Bulb No. 2 Hyd. fraction: 99.70</div> <div>Vacuum period (min): 10 Dispersion device: None</div>									
				Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<div><=Split</div> <div><=Split hyd.</div>	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
				8"	-	200	-		0.5	21.9	18	0.06891	74.65
				6"	-	150	-		1	21.9	16	0.04933	66.68
				4"	-	100	-		2	21.9	12	0.03571	50.73
				3"	-	75	-		5	21.9	7	0.02322	30.79
				1.5"	-	37.5	100.0		15	21.9	4.5	0.01359	20.82
3/4"	21.15	19	99.9	30	21.9	2.5	0.00971		12.85				
3/8"	51.10	9.5	99.7	60	21.9	2	0.00688		10.85				
No.4	-	4.75	99.7	120	22	1.5	0.00487	8.99					
No.10	0.05	2	99.7	250	22.6	0.5	0.00337	5.81					
No.20	0.04	0.85	99.5	462	23.5	0	0.00246	5.02					
No.40	0.14	0.425	99.1	1372	22	0	0.00145	3.01					
No.60	0.27	0.25	98.6										
No.100	0.40	0.15	98.1										
No.140	0.66	0.106	97.1										
No.200	1.19	0.075	95.0										



Entered by: _____

Reviewed: _____

Dispersive Characteristics of Clay Soil by Double Hydrometer
(ASTM D 4221)

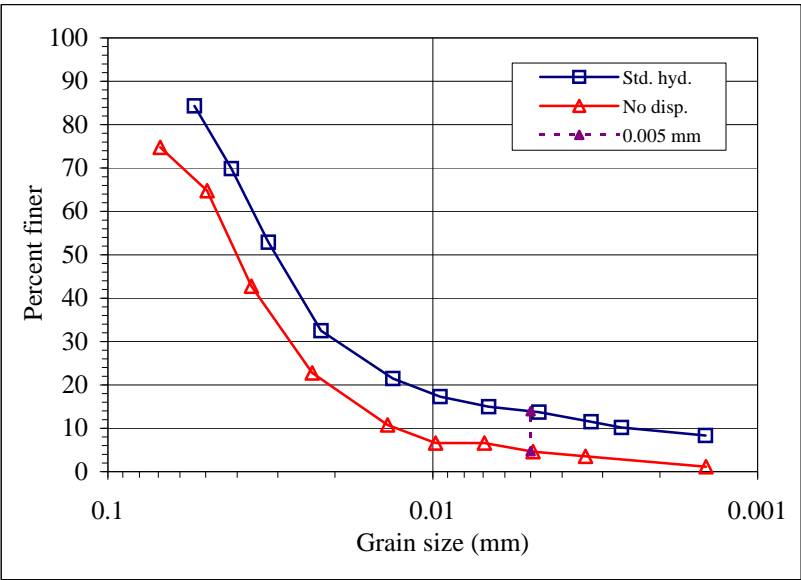


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Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

Boring No.: WUA-TP004-01
Sample:
Depth: 1-10'
Description: Brown silt

Percent passing 5 um (ASTM D 4221) =		4.72
Percent passing 5 um (ASTM D 422) =		13.93
Percent Dispersion =		33.9
Standard Hyd. (ASTM D 422)		
I	J	
Particle size (mm)	Percent finer	
0.0541	84.3	
0.0417	69.9	
0.0321	52.9	
0.0221	32.5	
0.0133	21.5	
0.0095	17.3	
0.0067	15.0	
0.0047	13.7	
0.0033	11.5	
0.0026	10.2	
0.0014	8.3	
Double Hyd. (ASTM D 4221)		
I	J	
Particle size (mm)	Percent finer	
0.0690	74.8	
0.0495	64.8	
0.0361	42.8	
0.0235	22.8	
0.0138	10.8	
0.0098	6.6	
0.0069	6.6	
0.0049	4.6	
0.0034	3.6	
0.0014	1.1	



Entered by: _____
Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

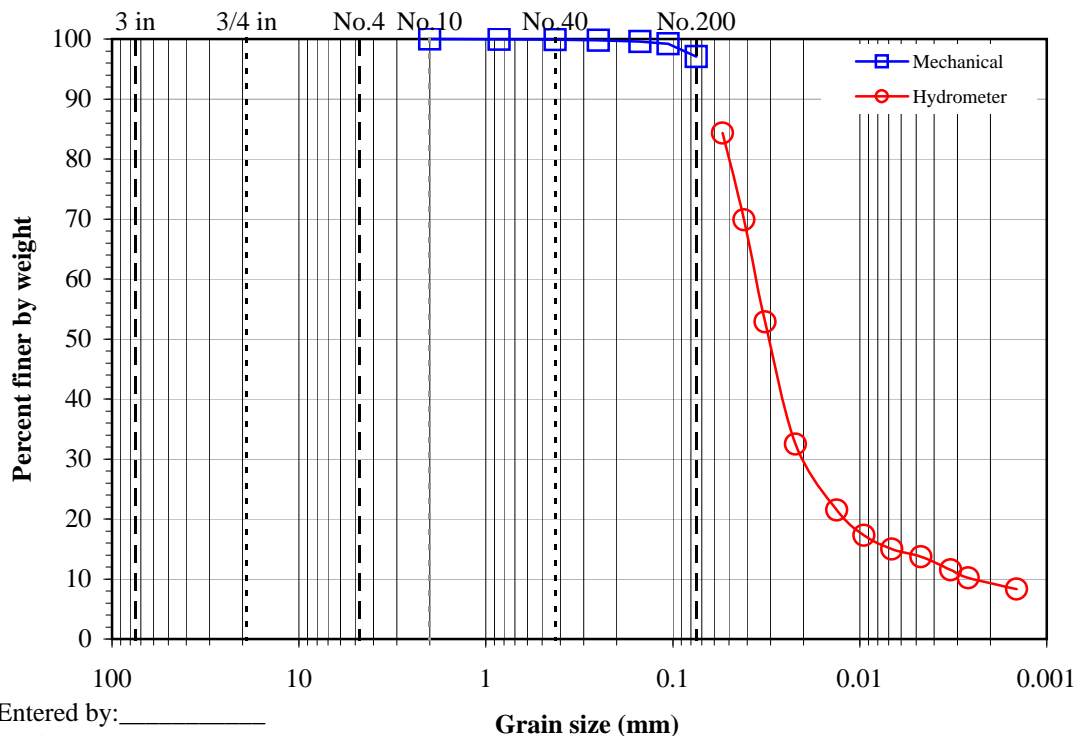
Boring No.: **WUA-TP004-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Split sieve: Yes Split sieve: #10 Moist Total sample wt. (g): 59.44 58.85 + #10 Coarse fraction (g): 0.00 - #10 Split fraction (g): 59.44 58.85 Hydrometer fraction (g): 59.44 58.85 Split fraction: 1.000				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(-No.10) Moist soil + tare (g): - 48.39 48.39 Dry soil + tare (g): - 48.28 48.28 Tare (g): - 37.39 37.39 Water content (%): 0.00 1.01 1.01			<u>Hydrometer data</u> Hyd. split: No.10 Slope: -0.1641 Gs: 2.65 Assumed Intercept: 16.3 Bulb No. 2 Hyd. fraction: 100.00 Dispersion period (min): 15 Dispersion device: Air-jet		
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer		Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-	<=Split	0.5	18.2	53.5	0.05413	84.32
6"	-	150	-		1	18.2	45	0.04167	69.87
4"	-	100	-		2	18.2	35	0.03207	52.88
3"	-	75	-		5	18.2	23	0.02209	32.49
1.5"	-	37.5	-		15	18.3	16.5	0.01327	21.48
3/4"	-	19	-		30	18.5	14	0.00950	17.30
3/8"	-	9.5	-		60	19.1	12.5	0.00673	14.98
No.4	-	4.75	-		120	20.3	11.5	0.00471	13.73
No.10	-	2	100.0		250	21.2	10	0.00326	11.51
No.20	0.02	0.85	100.0		380	22.2	9	0.00262	10.18
No.40	0.05	0.425	99.9		1275	21.8	8	0.00145	8.34
No.60	0.13	0.25	99.8						
No.100	0.24	0.15	99.6						
No.140	0.48	0.106	99.2						
No.200	1.73	0.075	97.1						



Gravel (%): 0.0
 Sand (%): 2.9
 Fines (%): 97.1

Entered by: _____

Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D4221)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/18/2013

By: BRR

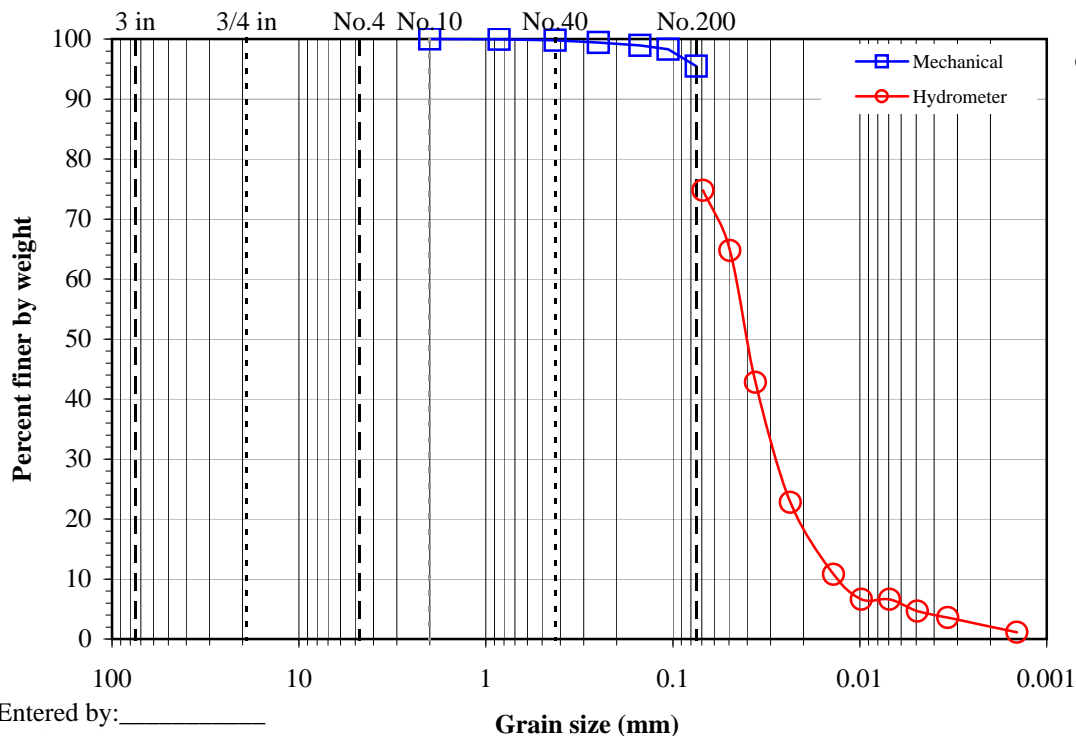
Boring No.: WUA-TP004-01

Sample:

Depth: 1-10'

Description: Brown silt

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 25.25 25.00 + #10 Coarse fraction (g): 0.00 - #10 Split fraction (g): 25.25 25.00 Hydrometer fraction (g): 25.25 25.00 Split fraction: 1.000				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(-No.10)					
				Moist soil + tare (g):		-	48.39	48.39	
				Dry soil + tare (g):		-	48.28	48.28	
				Tare (g):		-	37.39	37.39	
				Water content (%):		0.00	1.01	1.01	
				<u>Hydrometer data</u>					
				Hyd. split:		No.10	Slope:		-0.1641
Gs:		2.65	Assumed	Intercept: 16.3					
Bulb No.		2	α:		1.00				
Vacuum period (min):		10	Hyd. fraction:		100.00				
			Dispersion device:		None				
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-		0.5	21.8	18	0.06899	74.76
6"	-	150	-		1	21.8	15.5	0.04952	64.76
4"	-	100	-		2	21.8	10	0.03615	42.76
3"	-	75	-		5	21.8	5	0.02349	22.75
1.5"	-	37.5	-		15	21.8	2	0.01378	10.75
3/4"	-	19	-		30	21.7	1	0.00981	6.62
3/8"	-	9.5	-		60	21.7	1	0.00694	6.62
No.4	-	4.75	-		120	21.7	0.5	0.00492	4.62
No.10	-	2	100.0		250	22.4	0	0.00339	3.56
No.20	0.01	0.85	100.0		1440	20.6	0	0.00144	1.14
No.40	0.05	0.425	99.8						
No.60	0.14	0.25	99.4						
No.100	0.27	0.15	98.9						
No.140	0.43	0.106	98.3						
No.200	1.13	0.075	95.5						



Gravel (%): 0.0
Sand (%): 4.5
Fines (%): 95.5

Comments:

Vacuum applied and no flocculating agent used.

Entered by: _____

Reviewed: _____

Dispersive Characteristics of Clay Soil by Double Hydrometer
(ASTM D 4221)

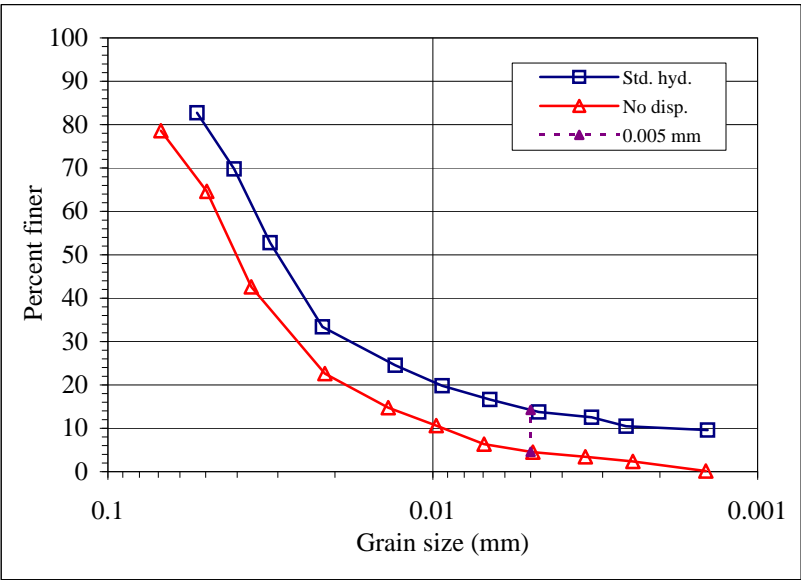


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Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

Boring No.: WUA-TP005-01
Sample:
Depth: 1-10'
Description: Brown silt

Percent passing 5 um (ASTM D 4221) =		4.57		
Percent passing 5 um (ASTM D 422) =		14.25		
Percent Dispersion =		32.1		
Standard Hyd. (ASTM D 422)			Double Hyd. (ASTM D 4221)	
I	J		I	J
Particle size (mm)	Percent finer		Particle size (mm)	Percent finer
0.0532	82.7		0.0687	78.6
0.0409	69.8		0.0496	64.6
0.0317	52.8		0.0362	42.6
0.0219	33.4		0.0215	22.6
0.0131	24.5		0.0137	14.8
0.0094	19.8		0.0098	10.6
0.0067	16.7		0.0069	6.4
0.0047	13.8		0.0049	4.5
0.0032	12.5		0.0034	3.4
0.0025	10.5		0.0024	2.4
0.0014	9.6		0.0014	0.1



Entered by: _____
Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/18/2013

By: BRR

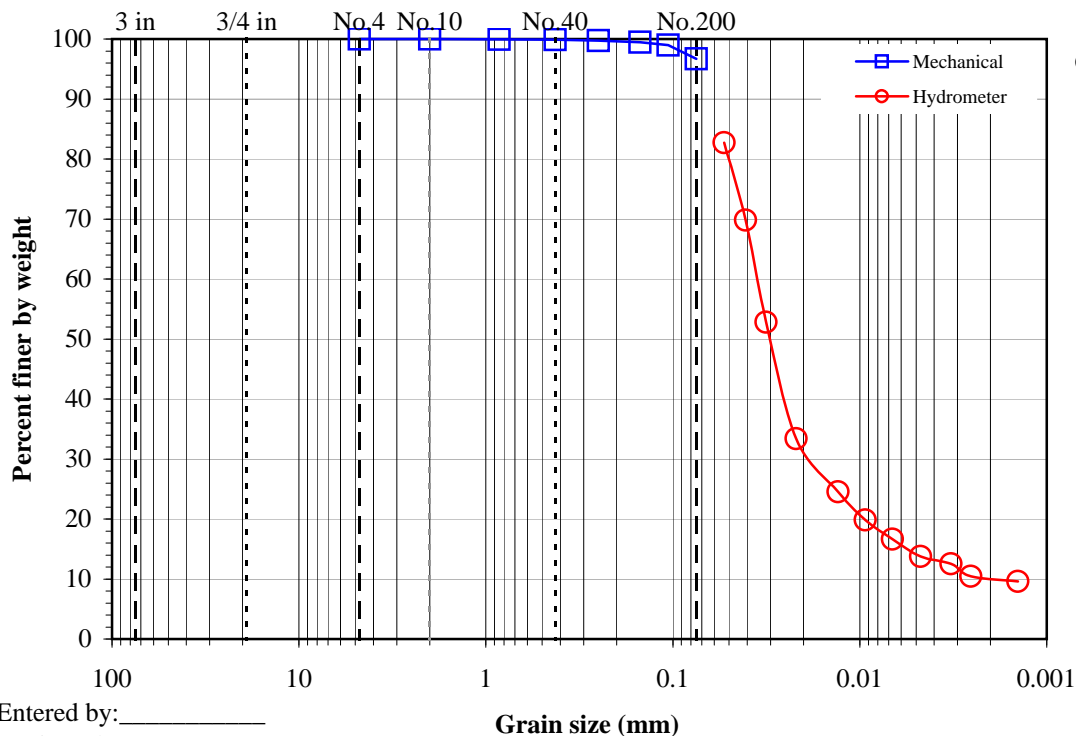
Boring No.: WUA-TP005-01

Sample:

Depth: 1-10'

Description: Brown silt

Split sieve: Yes Split sieve: #10 Moist Total sample wt. (g): 563.63 556.09 + #10 Coarse fraction (g): 0.01 0.01 - #10 Split fraction (g): 62.65 61.81 Hydrometer fraction (g): 62.65 61.81 Split fraction: 1.000				Water content data C.F.(+ #10) S.F.(- #10) Hyd.(-No.10) Moist soil + tare (g): 37.86 120.67 120.67 Dry soil + tare (g): 37.86 119.56 119.56 Tare (g): 37.84 37.75 37.75 Water content (%): 0.00 1.36 1.36			Hydrometer data Hyd. split: No.10 Slope: -0.1641 Gs: 2.65 Assumed Intercept: 16.3 Bulb No. 2 Hyd. fraction: 100.00 Dispersion period (min): 15 Dispersion device: Air-jet	
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-	0.5	18.3	55	0.05319	82.73
6"	-	150	-	1	18.3	47	0.04086	69.79
4"	-	100	-	2	18.3	36.5	0.03166	52.80
3"	-	75	-	5	18.3	24.5	0.02185	33.39
1.5"	-	37.5	-	15	18.4	19	0.01305	24.53
3/4"	-	19	-	30	18.8	16	0.00936	19.82
3/8"	-	9.5	-	60	19	14	0.00668	16.65
No.4	-	4.75	100.0	120	20	12	0.00472	13.77
No.10	0.01	2	100.0	250	21.1	11	0.00324	12.54
No.20	0.03	0.85	99.9	404	22.1	9.5	0.00254	10.47
No.40	0.08	0.425	99.9	1297	21.9	9	0.00143	9.59
No.60	0.17	0.25	99.7					
No.100	0.32	0.15	99.5					
No.140	0.61	0.106	99.0					
No.200	2.03	0.075	96.7					



Gravel (%): 0.0
Sand (%): 3.3
Fines (%): 96.7

Entered by: _____

Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D4221)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

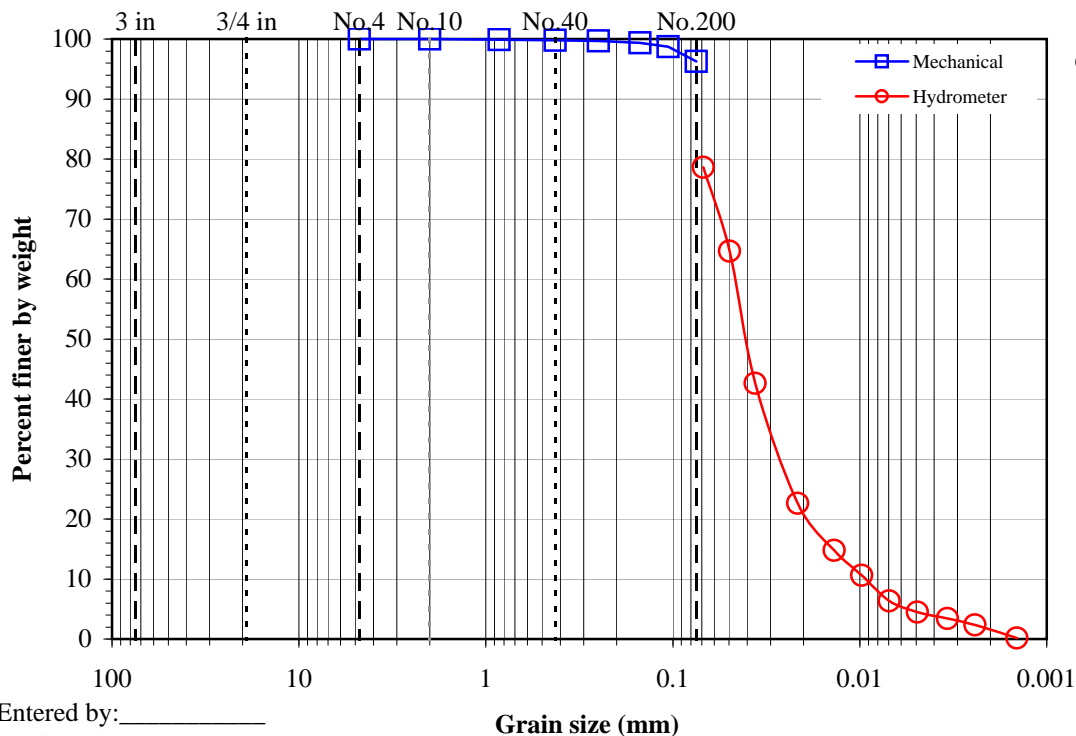
Boring No.: **WUA-TP005-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Split sieve: Yes Split sieve: #10 Moist Total sample wt. (g): 563.63 556.09 + #10 Coarse fraction (g): 0.01 0.01 - #10 Split fraction (g): 25.34 25.00 Hydrometer fraction (g): 25.34 25.00 Split fraction: 1.000				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(-No.10) Moist soil + tare (g): 37.86 120.67 120.67 Dry soil + tare (g): 37.86 119.56 119.56 Tare (g): 37.84 37.75 37.75 Water content (%): 0.00 1.36 1.36			<u>Hydrometer data</u> Hyd. split: No.10 Slope: -0.1641 Gs: 2.65 Assumed Intercept: 16.3 Bulb No. 2 Hyd. fraction: 100.00 Vacuum period (min): 10 Dispersion device: None	
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-	0.5	21.7	19	0.06867	78.61
6"	-	150	-	1	21.7	15.5	0.04960	64.62
4"	-	100	-	2	21.7	10	0.03621	42.62
3"	-	75	-	6	21.7	5	0.02148	22.62
1.5"	-	37.5	-	15	21.8	3	0.01371	14.75
3/4"	-	19	-	30	21.7	2	0.00976	10.62
3/8"	-	9.5	-	60	21.5	1	0.00695	6.35
No.4	-	4.75	100.0	120	21.6	0.5	0.00492	4.48
No.10	0.01	2	100.0	250	22.3	0	0.00339	3.42
No.20	0.02	0.85	99.9	484	23	-0.5	0.00242	2.36
No.40	0.05	0.425	99.8	1440	20.6	-0.25	0.00144	0.14
No.60	0.08	0.25	99.7					
No.100	0.16	0.15	99.4					
No.140	0.32	0.106	98.7					
No.200	0.93	0.075	96.3					



Gravel (%): 0.0
 Sand (%): 3.7
 Fines (%): 96.3

Comments:

Vacuum applied and no flocculating agent used.

Entered by: _____

Reviewed: _____

Dispersive Characteristics of Clay Soil by Double Hydrometer
(ASTM D 4221)

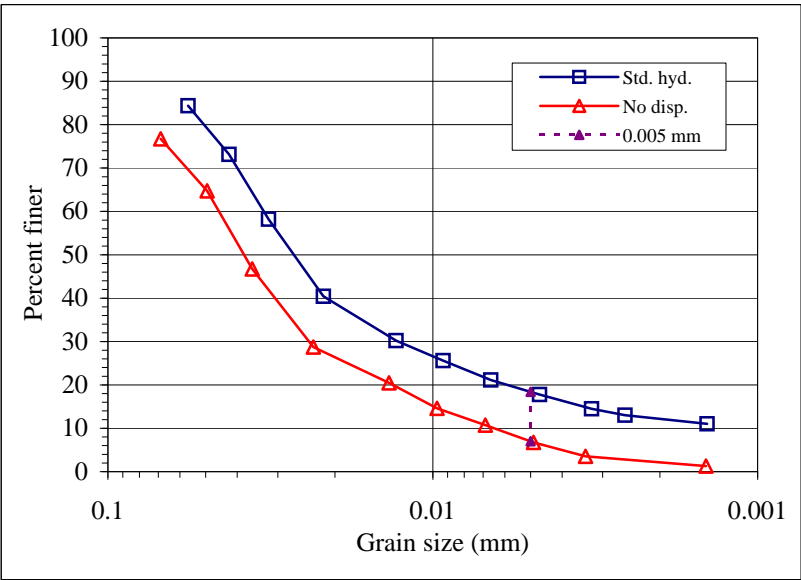


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Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

Boring No.: WUA-TP006-01
Sample:
Depth: 1-10'
Description: Brown silty clay

Percent passing 5 um (ASTM D 4221) =		7.00		
Percent passing 5 um (ASTM D 422) =		18.40		
Percent Dispersion =		38.0		
Standard Hyd. (ASTM D 422)			Double Hyd. (ASTM D 4221)	
I	J		I	J
Particle size (mm)	Percent finer		Particle size (mm)	Percent finer
0.0567	84.4		0.0688	76.7
0.0424	73.2		0.0495	64.7
0.0320	58.2		0.0359	46.7
0.0217	40.4		0.0233	28.7
0.0130	30.2		0.0136	20.5
0.0093	25.6		0.0097	14.6
0.0066	21.1		0.0069	10.8
0.0047	17.8		0.0049	6.8
0.0032	14.5		0.0034	3.6
0.0026	13.0		0.0014	1.3
0.0014	11.0			



Entered by: _____
Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

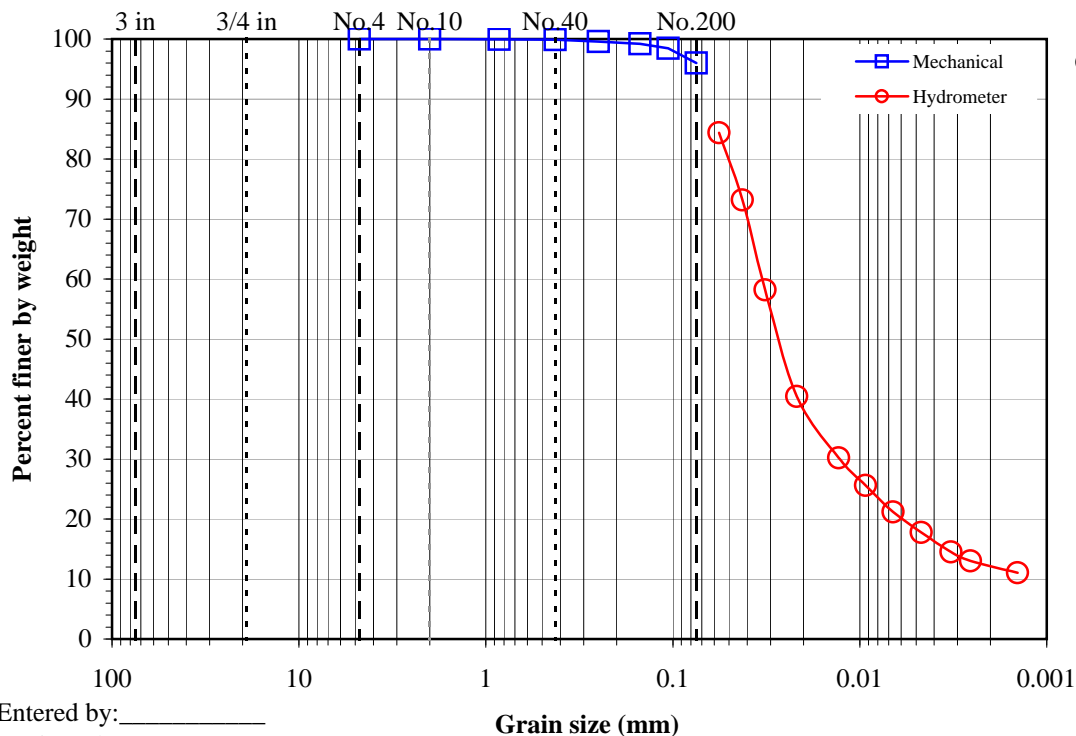
Boring No.: **WUA-TP006-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 575.27 551.95 + #10 Coarse fraction (g): 0.01 0.01 - #10 Split fraction (g): 55.76 53.50 Hydrometer fraction (g): 55.76 53.50 Split fraction: 1.000				Water content data C.F.(+ #10) S.F.(- #10) Hyd.(-No.10)							
				Moist soil + tare (g):		37.60	102.43	102.43			
				Dry soil + tare (g):		37.60	99.79	99.79			
				Tare (g):		37.57	37.31	37.31			
				Water content (%):		0.00	4.23	4.23			
				Hydrometer data						Slope:	-0.1641
				Hyd. split:		No.10			Intercept:	16.3	
Gs:		2.65	Assumed			α:	1.00				
Bulb No.		2			Hyd. fraction:	100.00					
Dispersion period (min):		15			Dispersion device:	Air-jet					
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension		
8"	-	200	-		0.5	18.3	49	0.05667	84.37		
6"	-	150	-		1	18.3	43	0.04239	73.16		
4"	-	100	-		2	18.3	35	0.03204	58.20		
3"	-	75	-		5	18.3	25.5	0.02171	40.45		
1.5"	-	37.5	-		15	18.4	20	0.01297	30.21		
3/4"	-	19	-		30	18.6	17.5	0.00929	25.62		
3/8"	-	9.5	-		60	19.1	15	0.00663	21.15		
No.4	-	4.75	100.0		120	20	13	0.00469	17.78		
No.10	0.01	2	100.0		250	21.1	11	0.00324	14.49		
No.20	0.02	0.85	100.0		396	22.1	10	0.00256	13.03		
No.40	0.06	0.425	99.9		1290	21.8	9	0.00143	11.04		
No.60	0.22	0.25	99.6								
No.100	0.44	0.15	99.2								
No.140	0.82	0.106	98.5								
No.200	2.13	0.075	96.0								



Gravel (%): 0.0
Sand (%): 4.0
Fines (%): 96.0

Particle-Size Analysis of Soils with hydrometer

(ASTM D4221)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/18/2013

By: BRR

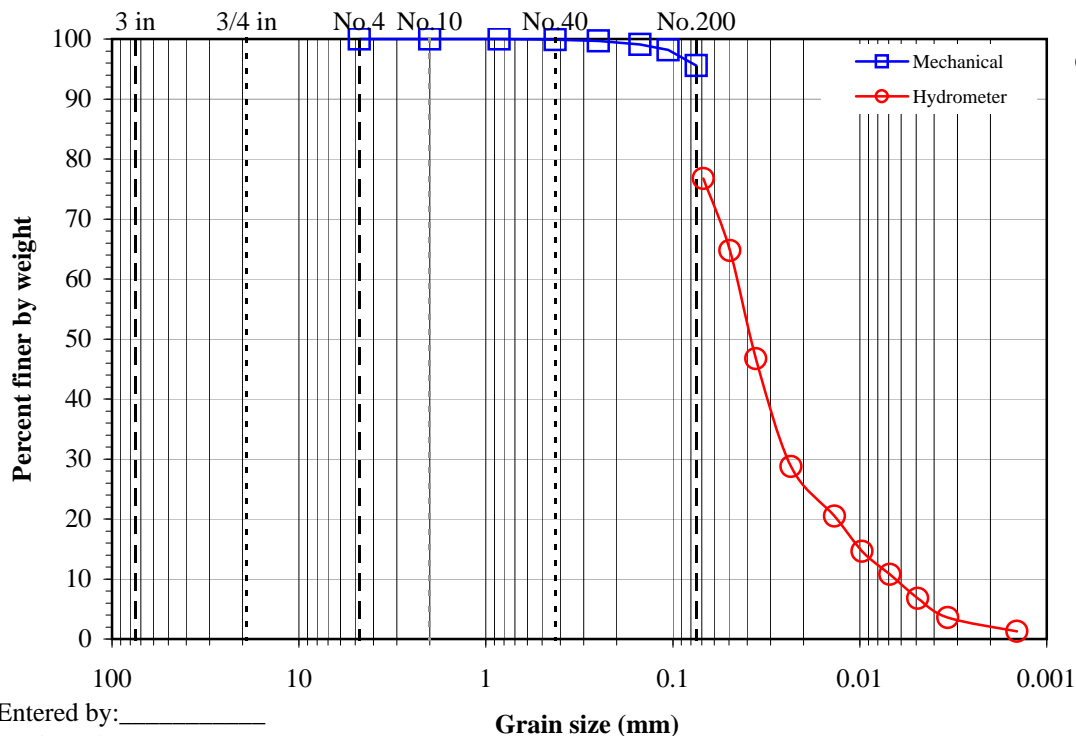
Boring No.: WUA-TP006-01

Sample:

Depth: 1-10'

Description: Brown silty clay

Split sieve: Yes Split sieve: #10 Moist Total sample wt. (g): 575.27 551.95 + #10 Coarse fraction (g): 0.01 0.01 - #10 Split fraction (g): 26.06 25.00 Hydrometer fraction (g): 26.06 25.00 Split fraction: 1.000				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(-No.10) Moist soil + tare (g): 37.60 102.43 102.43 Dry soil + tare (g): 37.60 99.79 99.79 Tare (g): 37.57 37.31 37.31 Water content (%): 0.00 4.23 4.23			<u>Hydrometer data</u> Hyd. split: No.10 Slope: -0.1641 Gs: 2.65 Assumed Intercept: 16.3 Bulb No. 2 Hyd. fraction: 100.00 Vacuum period (min): 10 Dispersion device: None	
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-	0.5	21.8	18.5	0.06877	76.74
6"	-	150	-	1	21.8	15.5	0.04952	64.74
4"	-	100	-	2	21.8	11	0.03595	46.75
3"	-	75	-	5	21.8	6.5	0.02331	28.75
1.5"	-	37.5	-	15	21.6	4.5	0.01364	20.48
3/4"	-	19	-	30	21.7	3	0.00971	14.62
3/8"	-	9.5	-	60	21.8	2	0.00689	10.75
No.4	-	4.75	100.0	120	21.8	1	0.00490	6.75
No.10	0.01	2	100.0	250	22.4	0	0.00339	3.56
No.20	-	0.85	100.0	1436	20.7	0	0.00144	1.28
No.40	0.02	0.425	99.9	<=Split				
No.60	0.08	0.25	99.7					
No.100	0.22	0.15	99.1					
No.140	0.45	0.106	98.2					
No.200	1.10	0.075	95.6					



Gravel (%): 0.0

Sand (%): 4.4

Fines (%): 95.6

Comments:

Vacuum applied and no flocculating agent used.

Dispersive Characteristics of Clay Soil by Double Hydrometer

(ASTM D 4221)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/18/2013

By: BRR

Boring No.: WUA-TP007-01

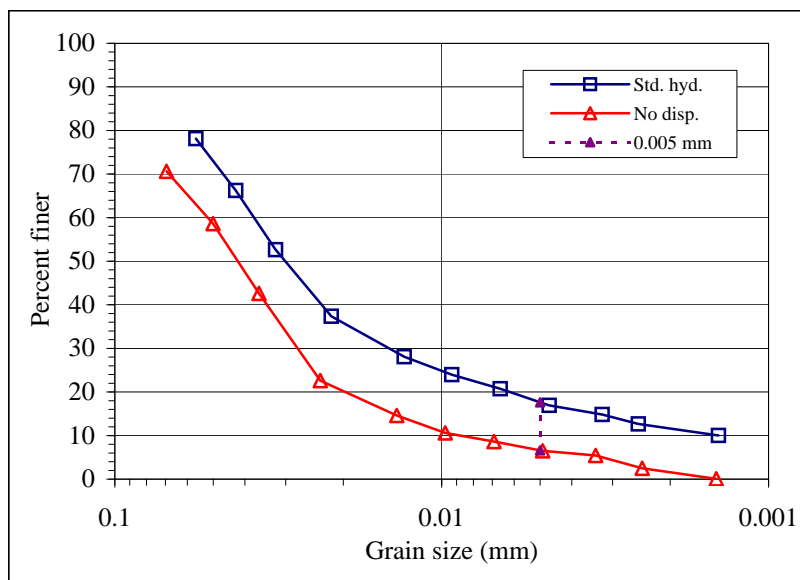
Sample:

Depth: 1-10'

Description: Brown silt

Percent passing 5 um (ASTM D 4221) =		6.60
Percent passing 5 um (ASTM D 422) =		17.63
Percent Dispersion =		37.4

Standard Hyd. (ASTM D 422)			Double Hyd. (ASTM D 4221)	
I	J		I	J
Particle size (mm)	Percent finer		Particle size (mm)	Percent finer
0.0565	78.1		0.0695	70.6
0.0427	66.2		0.0500	58.6
0.0322	52.7		0.0362	42.6
0.0218	37.4		0.0235	22.6
0.0130	28.1		0.0137	14.6
0.0093	24.0		0.0098	10.6
0.0066	20.7		0.0069	8.6
0.0047	16.9		0.0049	6.5
0.0032	14.8		0.0034	5.4
0.0025	12.7		0.0024	2.5
0.0014	10.0		0.0014	0.1



Entered by: _____

Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

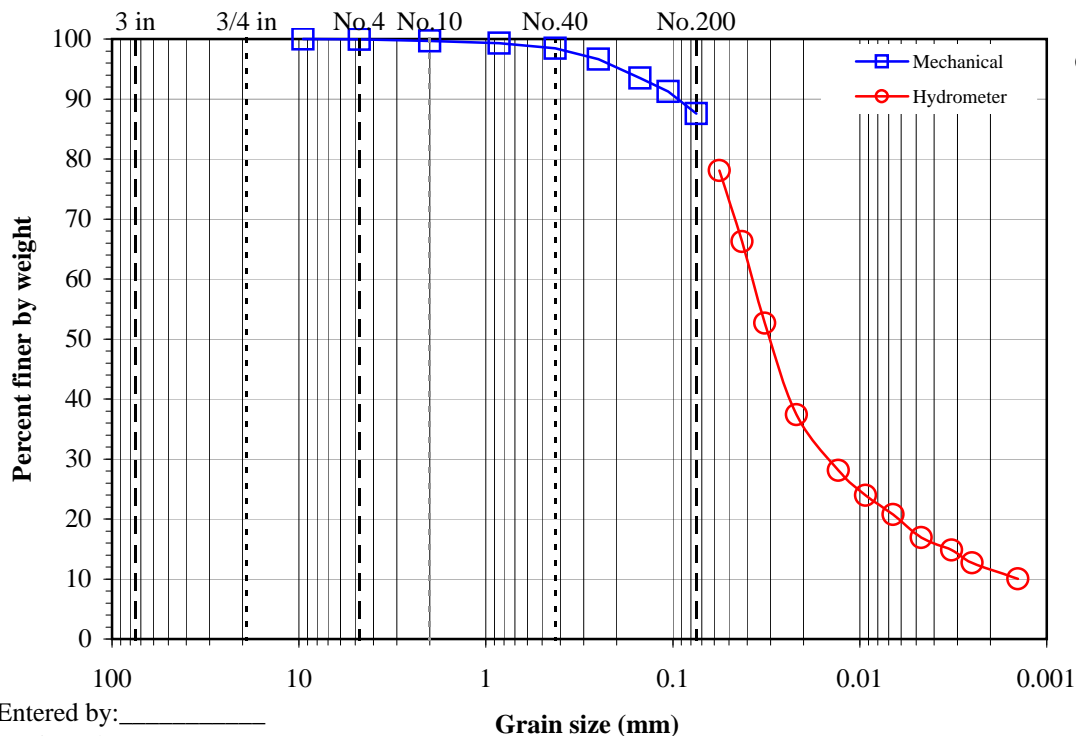
Boring No.: **WUA-TP007-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Split sieve: Yes Split sieve: #10 Moist Total sample wt. (g): 471.57 463.58 + #10 Coarse fraction (g): 1.38 1.37 - #10 Split fraction (g): 59.77 58.76 Hydrometer fraction (g): 59.77 58.76 Split fraction: 0.997				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(-No.10) Moist soil + tare (g): 41.56 96.71 96.71 Dry soil + tare (g): 41.53 95.71 95.71 Tare (g): 38.15 37.76 37.76 Water content (%): 0.89 1.73 1.73			<u>Hydrometer data</u> Hyd. split: No.10 Slope: -0.1641 Gs: 2.65 Assumed Intercept: 16.3 Bulb No. 2 Hyd. fraction: 99.70 Dispersion period (min): 15 Dispersion device: Air-jet	
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-	0.5	17.8	50	0.05645	78.11
6"	-	150	-	1	17.8	43	0.04266	66.23
4"	-	100	-	2	17.8	35	0.03223	52.65
3"	-	75	-	5	17.8	26	0.02177	37.38
1.5"	-	37.5	-	15	17.9	20.5	0.01301	28.09
3/4"	-	19	-	30	18.2	18	0.00931	23.95
3/8"	-	9.5	100.0	60	18.7	16	0.00662	20.75
No.4	0.25	4.75	99.9	120	19.8	13.5	0.00469	16.91
No.10	1.38	2	99.7	250	21	12	0.00323	14.81
No.20	0.23	0.85	99.3	412	22.1	10.5	0.00250	12.68
No.40	0.73	0.425	98.5	1305	21.8	9	0.00142	10.02
No.60	1.81	0.25	96.6					
No.100	3.65	0.15	93.5					
No.140	4.97	0.106	91.3					
No.200	7.16	0.075	87.6					



Gravel (%): 0.1
Sand (%): 12.4
Fines (%): 87.6

Particle-Size Analysis of Soils with hydrometer

(ASTM D4221)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

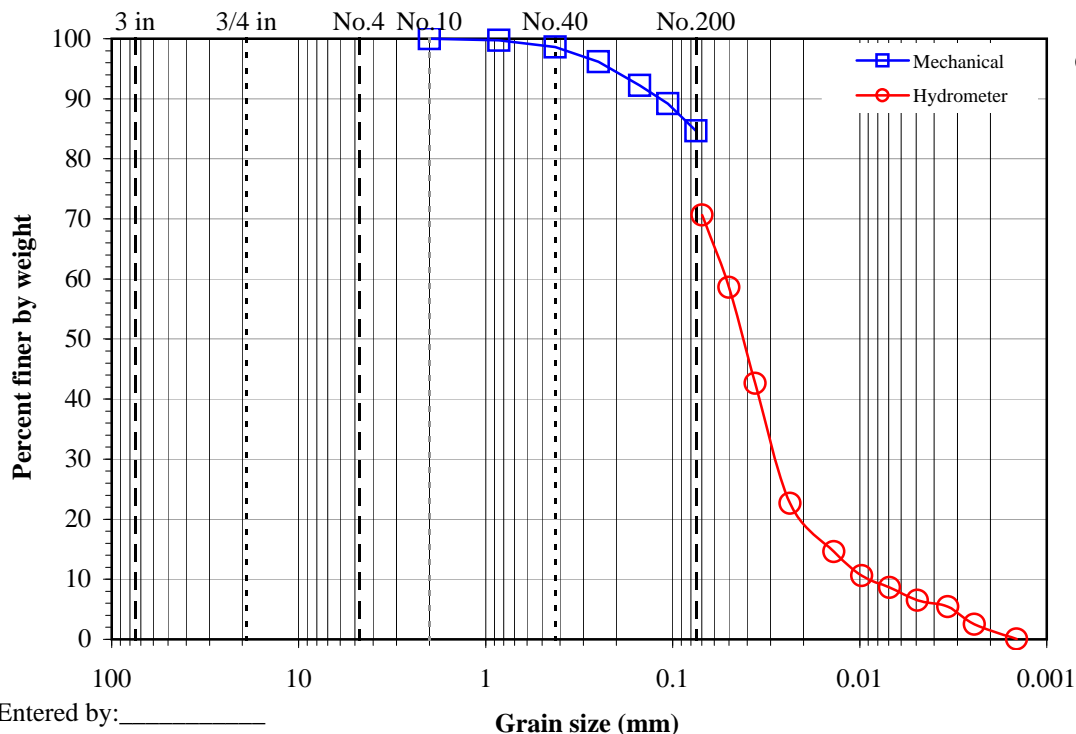
Boring No.: **WUA-TP007-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 25.43 25.00 + #10 Coarse fraction (g): 0.00 - #10 Split fraction (g): 25.43 25.00 Hydrometer fraction (g): 25.43 25.00 Split fraction: 1.000				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(- No.10)					
				Moist soil + tare (g):		-	96.71	96.71	
				Dry soil + tare (g):		-	95.71	95.71	
				Tare (g):		-	37.76	37.76	
				Water content (%):		0.00	1.73	1.73	
				<u>Hydrometer data</u>					
				Hyd. split:		No.10	Slope:		-0.1641
Gs:		2.65	Assumed	Intercept: 16.3					
Bulb No.		2	Hyd. fraction:		100.00				
Vacuum period (min):		10	Dispersion device:		None				
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-		0.5	21.7	17	0.06952	70.62
6"	-	150	-		1	21.7	14	0.05004	58.62
4"	-	100	-		2	21.7	10	0.03621	42.62
3"	-	75	-		5	21.7	5	0.02353	22.62
1.5"	-	37.5	-		15	21.7	3	0.01373	14.62
3/4"	-	19	-		30	21.7	2	0.00976	10.62
3/8"	-	9.5	-		60	21.7	1.5	0.00692	8.62
No.4	-	4.75	-		120	21.6	1	0.00491	6.49
No.10	-	2	100.0		250	22.3	0.5	0.00338	5.42
No.20	0.07	0.85	99.7		477	23.1	-0.5	0.00244	2.50
No.40	0.35	0.425	98.6		1432	20.7	-0.3	0.00145	0.08
No.60	0.96	0.25	96.2						
No.100	1.94	0.15	92.2						
No.140	2.70	0.106	89.2						
No.200	3.84	0.075	84.6						



Gravel (%): 0.0

Sand (%): 15.4

Fines (%): 84.6

Comments:

Vacuum applied and no flocculating agent used.

Dispersive Characteristics of Clay Soil by Double Hydrometer
(ASTM D 4221)

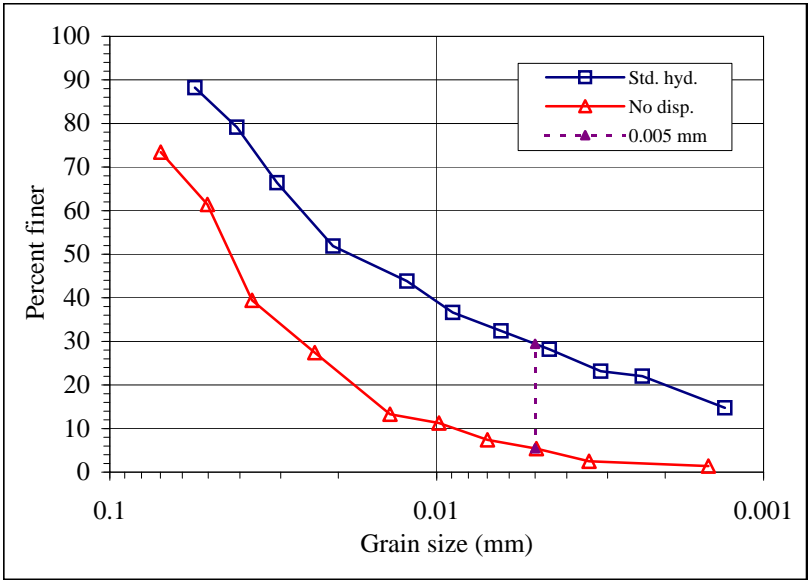


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Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

Boring No.: WUA-TP008-01
Sample:
Depth: 1-10'
Description: Brown silt

Percent passing 5 um (ASTM D 4221) =		5.46	
Percent passing 5 um (ASTM D 422) =		29.43	
Percent Dispersion =		18.6	
Standard Hyd. (ASTM D 422)		Double Hyd. (ASTM D 4221)	
I	J	I	J
Particle size (mm)	Percent finer	Particle size (mm)	Percent finer
0.0549	88.2	0.0698	73.4
0.0409	79.1	0.0503	61.4
0.0308	66.4	0.0367	39.4
0.0207	51.9	0.0236	27.4
0.0123	43.8	0.0139	13.3
0.0089	36.6	0.0098	11.3
0.0064	32.4	0.0070	7.4
0.0045	28.2	0.0050	5.4
0.0032	23.2	0.0034	2.5
0.0024	22.0	0.0015	1.4
0.0013	14.8		



Entered by: _____
Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

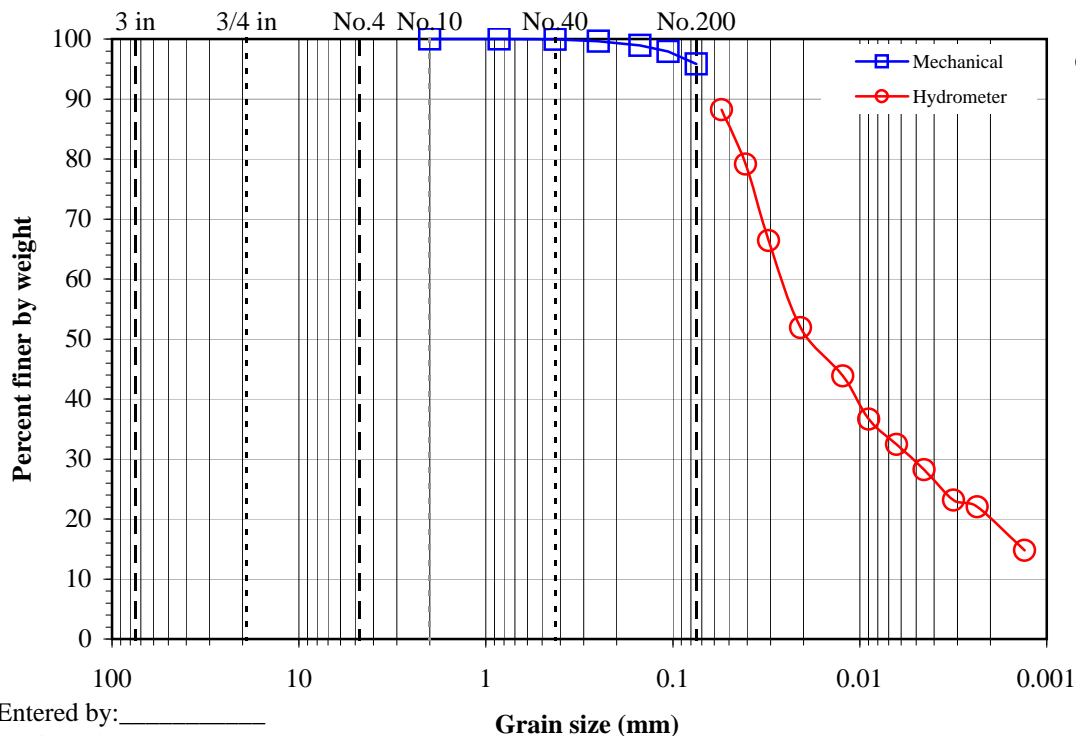
Boring No.: **WUA-TP008-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 56.17 55.03 + #10 Coarse fraction (g): 0.00 - #10 Split fraction (g): 56.17 55.03 Hydrometer fraction (g): 56.17 55.03 Split fraction: 1.000				<u>Water content data</u> C.F.(+ #10) S.F.(- #10) Hyd.(-No.10)					
				Moist soil + tare (g):		-	111.09	111.09	
				Dry soil + tare (g):		-	109.59	109.59	
				Tare (g):		-	37.30	37.30	
				Water content (%):		0.00	2.07	2.07	
				<u>Hydrometer data</u>					



Entered by: _____

Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D4221)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

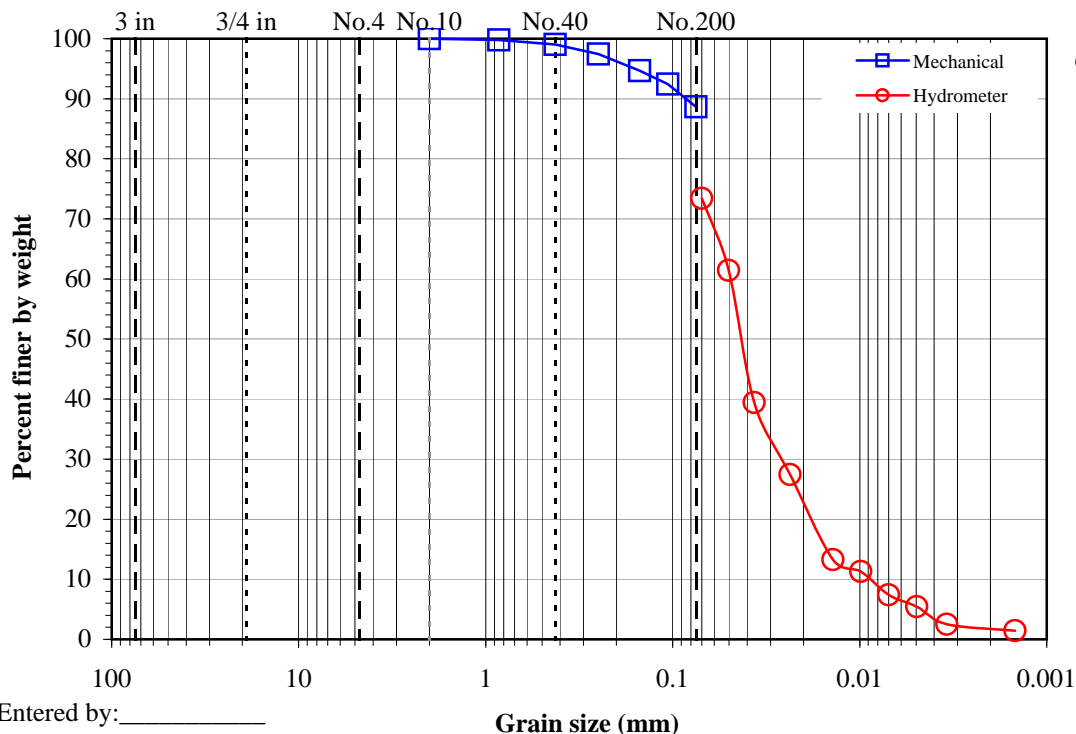
Boring No.: **WUA-TP008-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Split sieve: Yes Split sieve: #10 Moist Dry Total sample wt. (g): 25.52 25.00 + #10 Coarse fraction (g): 0.00 - #10 Split fraction (g): 25.52 25.00 Hydrometer fraction (g): 25.52 25.00 Split fraction: 1.000				Water content data C.F.(+ #10) S.F.(- #10) Hyd.(-No.10)					
				Moist soil + tare (g):		-	111.09	111.09	
				Dry soil + tare (g):		-	109.59	109.59	
				Tare (g):		-	37.30	37.30	
				Water content (%):		0.00	2.07	2.07	
				Hydrometer data					
				Hyd. split:		No.10	Slope:		-0.1641
Gs:		2.65	Assumed	Intercept:		16.3			
Bulb No.		2	α:		1.00				
Vacuum period (min):		10	Hyd. fraction:		100.00				
			Dispersion device:		None				
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
8"	-	200	-		0.5	20.8	18	0.06984	73.41
6"	-	150	-		1	20.8	15	0.05029	61.41
4"	-	100	-		2	20.8	9.5	0.03670	39.41
3"	-	75	-		5	20.8	6.5	0.02360	27.41
1.5"	-	37.5	-		15	20.7	3	0.01389	13.28
3/4"	-	19	-		30	20.7	2.5	0.00985	11.28
3/8"	-	9.5	-		60	20.8	1.5	0.00699	7.41
No.4	-	4.75	-		120	20.8	1	0.00496	5.41
No.10	-	2	100.0		250	21.6	0	0.00342	2.48
No.20	0.05	0.85	99.8		1370	20.8	0	0.00147	1.41
No.40	0.24	0.425	99.0						
No.60	0.64	0.25	97.4						
No.100	1.33	0.15	94.7						
No.140	1.89	0.106	92.4						
No.200	2.84	0.075	88.6						



Gravel (%): 0.0

Sand (%): 11.4

Fines (%): 88.6

Comments:

Vacuum applied and no flocculating agent used.

Entered by: _____

Reviewed: _____

Dispersive Characteristics of Clay Soil by Double Hydrometer

(ASTM D 4221)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/18/2013

By: BRR

Boring No.: WUA-TP009-01

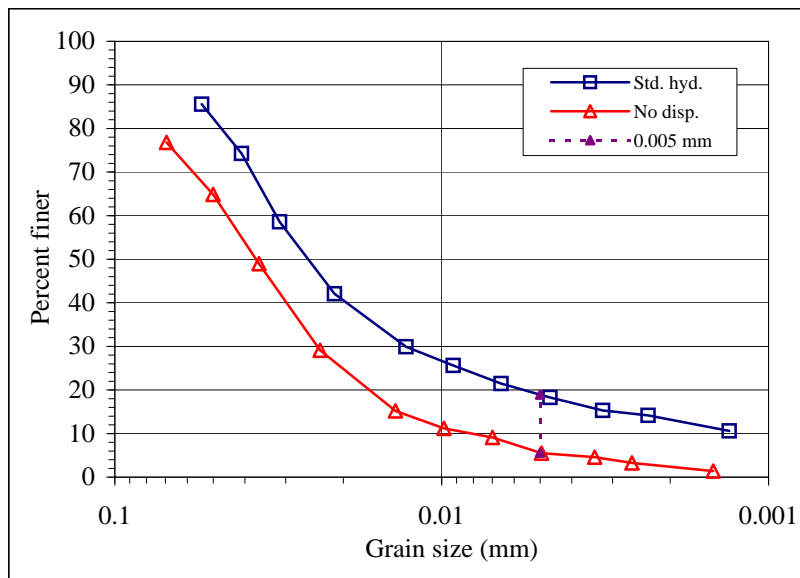
Sample:

Depth: 1-10'

Description: Brown silty clay

Percent passing 5 um (ASTM D 4221) =		5.62
Percent passing 5 um (ASTM D 422) =		18.93
Percent Dispersion =		29.7

Standard Hyd. (ASTM D 422)			Double Hyd. (ASTM D 4221)	
I	J		I	J
Particle size (mm)	Percent finer		Particle size (mm)	Percent finer
0.0542	85.6		0.0695	76.8
0.0409	74.3		0.0500	64.9
0.0313	58.6		0.0362	49.0
0.0213	42.1		0.0236	29.1
0.0129	29.9		0.0139	15.2
0.0092	25.6		0.0098	11.2
0.0066	21.5		0.0070	9.1
0.0047	18.3		0.0049	5.5
0.0032	15.3		0.0034	4.6
0.0023	14.2		0.0026	3.3
0.0013	10.6		0.0015	1.4



Entered by: _____

Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



© IGES 2004, 2013

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/18/2013**

By: **BRR**

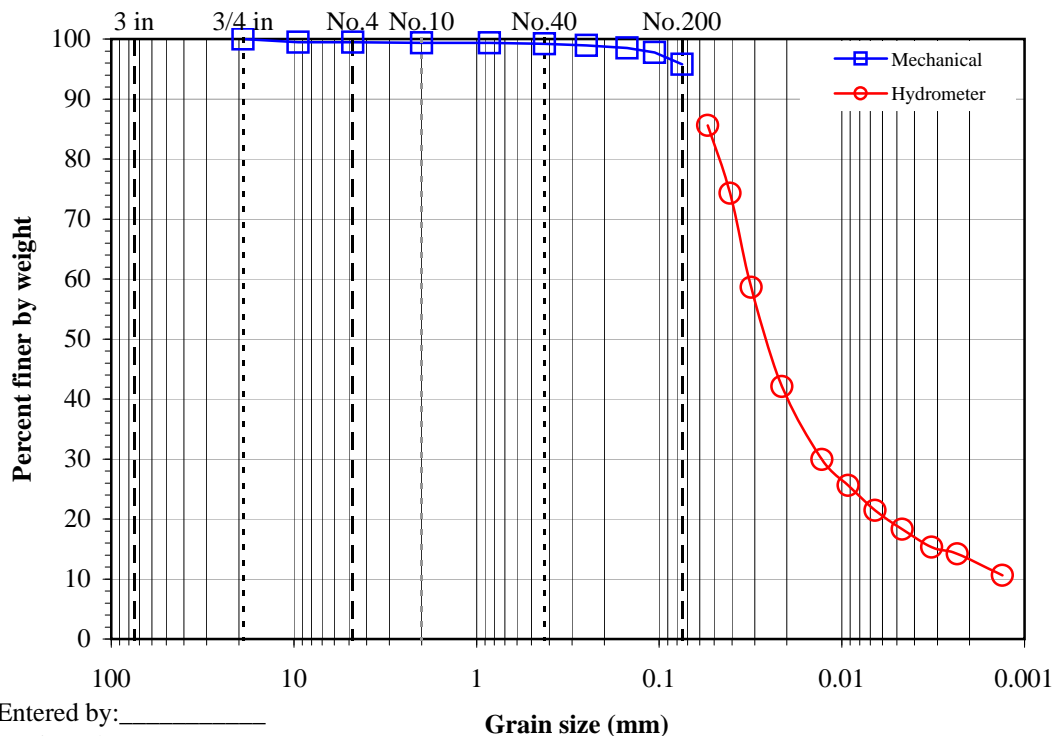
Boring No.: **WUA-TP009-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Split sieve: Yes Split sieve: 3/8" Moist Dry Total sample wt. (g): 22005.77 20355.03 +3/8" Coarse fraction (g): 112.96 112.53 -3/8" Split fraction (g): 518.78 511.47 Hydrometer fraction (g): 58.07 57.11 Split fraction: 0.994				<u>Water content data</u> C.F.(+3/8") S.F.(-3/8") Hyd.(+No.10) Hyd.(-No.10)					
				Moist soil + tare (g):		241.03	660.11	38.52	55.26
				Dry soil + tare (g):		240.59	619.64	38.51	54.97
				Tare (g):		126.36	123.24	37.81	37.72
				Water content (%):		0.39	8.15	1.43	1.68
				<u>Hydrometer data</u>				Slope: -0.1641	
				Hyd. split:		No.10	Intercept: 16.3		
Gs:		2.65	Assumed	α: 1.00					
Bulb No.		2	Hyd. fraction: 99.37						
Dispersion period (min):		15	Dispersion device: Air-jet						
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split <					



Gravel (%): 0.6
Sand (%): 3.7
Fines (%): 95.8

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



© IGES 2004, 2013

Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/18/2013

By: BRR

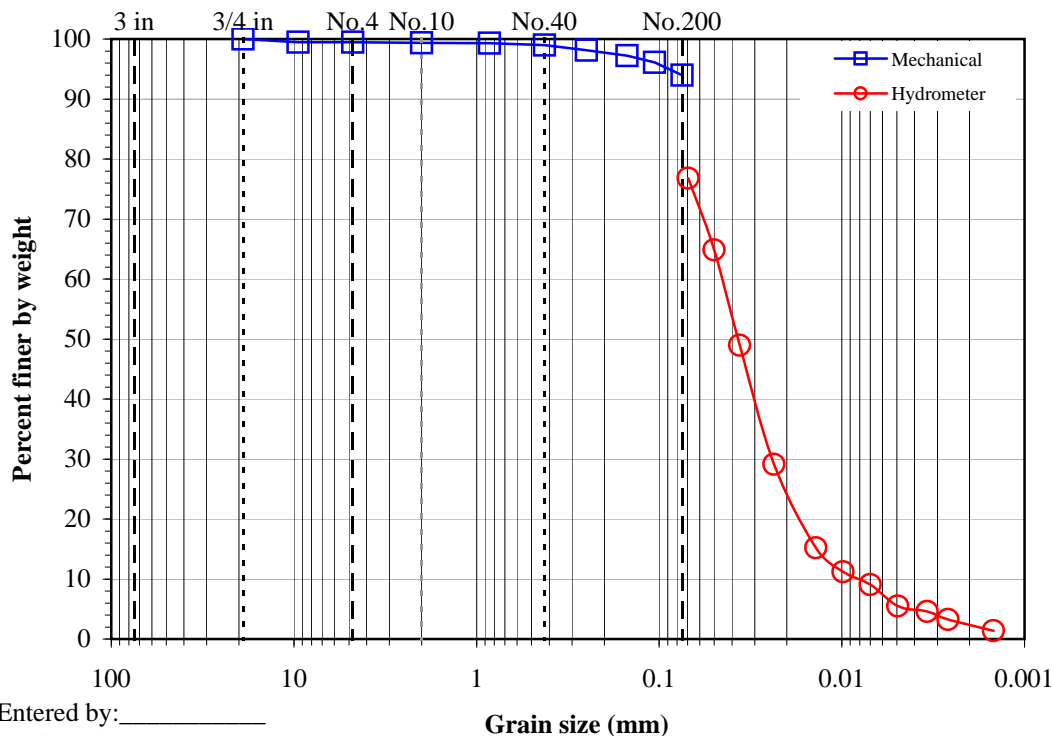
Boring No.: WUA-TP009-01

Sample:

Depth: 1-10'

Description: Brown silty clay

<div>Split sieve: Yes</div> <div>Split sieve: 3/8"</div> <div>Moist Dry</div> <div>Total sample wt. (g): 22005.77 20355.03</div> <div>+3/8" Coarse fraction (g): 112.96 112.53</div> <div>-3/8" Split fraction (g): 518.78 511.47</div> <div>Hydrometer fraction (g): 25.42 25.00</div> <div>Split fraction: 0.994</div>				<div>Water content data</div> <div>C.F.(+3/8") S.F.(-3/8") Hyd.(+No.10) Hyd.(-No.10)</div> <div>Moist soil + tare (g): 241.03 660.11 38.52 55.26</div> <div>Dry soil + tare (g): 240.59 619.64 38.51 54.97</div> <div>Tare (g): 126.36 123.24 37.81 37.72</div> <div>Water content (%): 0.39 8.15 1.43 1.68</div>									
				<div>Hydrometer data</div> <div>Slope: -0.1641</div> <div>Hyd. split: No.10 Intercept: 16.3</div> <div>Gs: 2.65 Assumed α: 1.00</div> <div>Bulb No. 2 Hyd. fraction: 99.37</div> <div>Vacuum period (min): 10 Dispersion device: None</div>									
				Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
				8"	-	200	-		0.5	20.7	19	0.06948	76.79
				6"	-	150	-		1	20.7	16	0.05004	64.87
				4"	-	100	-		2	20.7	12	0.03622	48.97
				3"	-	75	-		5	20.7	7	0.02356	29.09
1.5"	-	37.5	-	15	20.7	3.5	0.01386		15.18				
3/4"	-	19	100.0	30	20.7	2.5	0.00985		11.21				
3/8"	112.53	9.5	99.4	<=Split hyd.	60	20.6	2	0.00699	9.09				
No.4	-	4.75	99.4		120	20.9	1	0.00495	5.51				
No.10	0.39	2	99.4		250	21.7	0.5	0.00341	4.59				
No.20	0.02	0.85	99.3		420	22.2	0	0.00262	3.27				
No.40	0.10	0.425	99.0		1367	20.8	0	0.00148	1.40				
No.60	0.31	0.25	98.1										
No.100	0.54	0.15	97.2										
No.140	0.82	0.106	96.1										
No.200	1.36	0.075	94.0										



Entered by: _____

Reviewed: _____

Dispersive Characteristics of Clay Soil by Double Hydrometer
(ASTM D 4221)

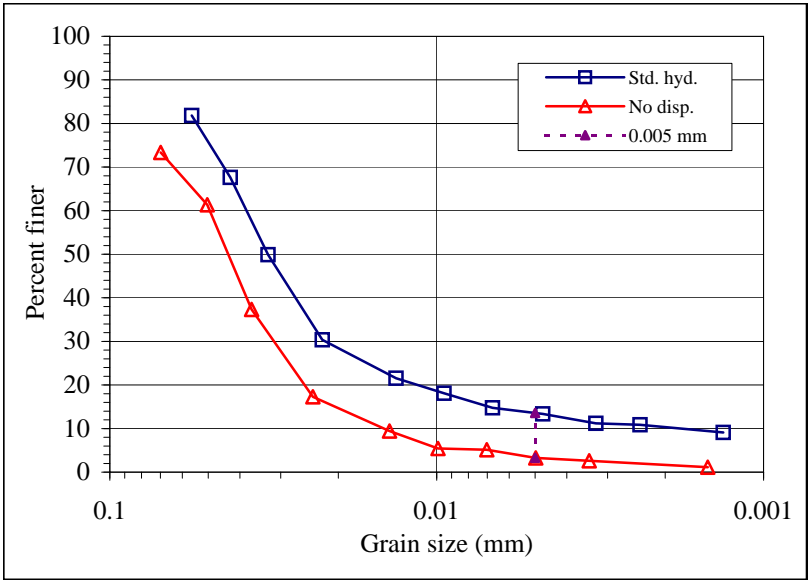


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Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 11/18/2013
By: BRR

Boring No.: WUA-TP010-01
Sample:
Depth: 1-10'
Description: Brown silt

Percent passing 5 um (ASTM D 4221) =		3.31		
Percent passing 5 um (ASTM D 422) =		13.58		
Percent Dispersion =		24.4		
Standard Hyd. (ASTM D 422)			Double Hyd. (ASTM D 4221)	
I	J		I	J
Particle size (mm)	Percent finer		Particle size (mm)	Percent finer
0.0562	81.8		0.0699	73.4
0.0428	67.6		0.0503	61.3
0.0328	49.9		0.0368	37.3
0.0224	30.4		0.0239	17.3
0.0133	21.5		0.0139	9.4
0.0095	18.1		0.0099	5.4
0.0067	14.8		0.0070	5.2
0.0047	13.4		0.0050	3.3
0.0033	11.2		0.0034	2.6
0.0024	10.9		0.0015	1.1
0.0013	9.1			



Entered by: _____
Reviewed: _____

Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/18/2013

By: BRR

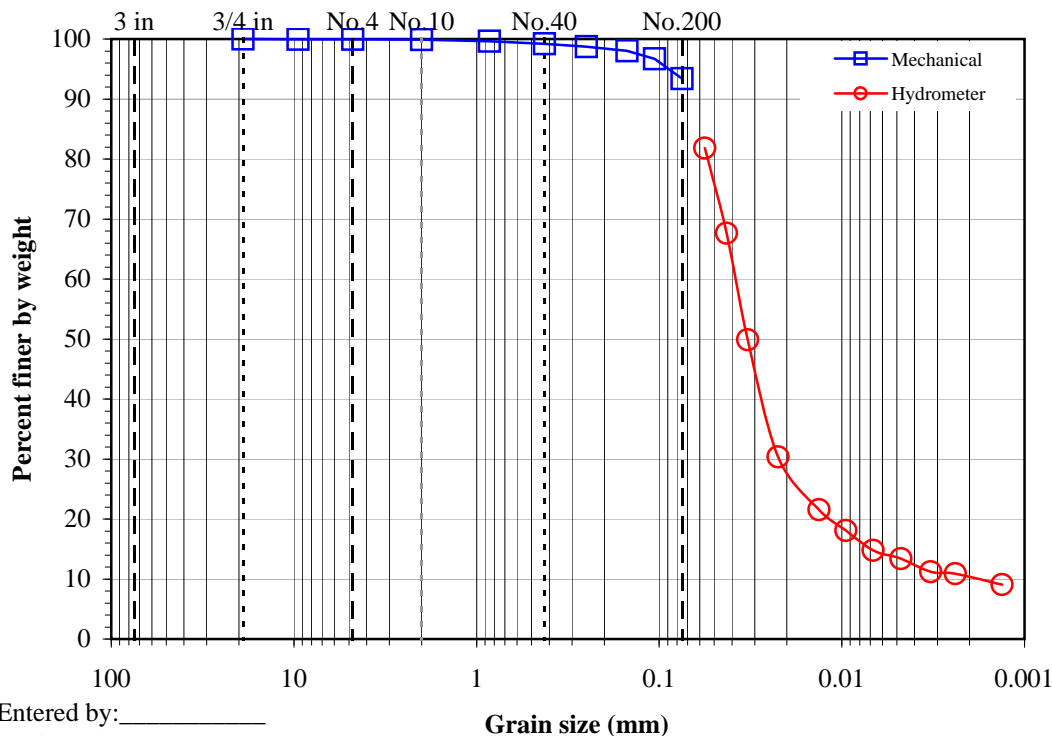
Boring No.: WUA-TP010-01

Sample:

Depth: 1-10'

Description: Brown silt

<div>Split sieve: Yes</div> <div>Split sieve: 3/8"</div> <div>Moist Dry</div> <div>Total sample wt. (g): 21537.22 20320.52</div> <div>+3/8" Coarse fraction (g): 16.12 15.99</div> <div>-3/8" Split fraction (g): 373.84 373.84</div> <div>Hydrometer fraction (g): 57.15 56.32</div> <div>Split fraction: 0.999</div>				<div>Water content data</div> <div>C.F.(+3/8") S.F.(-3/8") Hyd.(+No.10) Hyd.(-No.10)</div> <div>Moist soil + tare (g): 140.19 485.30 36.95 60.98</div> <div>Dry soil + tare (g): 140.06 464.88 36.95 60.64</div> <div>Tare (g): 124.07 124.07 36.93 37.60</div> <div>Water content (%): 0.81 5.99 0.00 1.48</div>									
				<div>Hydrometer data</div> <div>Slope: -0.1641</div> <div>Hyd. split: No.10 Intercept: 16.3</div> <div>Gs: 2.65 Assumed α: 1.00</div> <div>Bulb No. 2 Hyd. fraction: 99.92</div> <div>Dispersion period (min): 15 Dispersion device: Air-jet</div>									
				Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
				8"	-	200	-		0.5	18.2	50	0.05616	81.82
				6"	-	150	-		1	18.2	42	0.04281	67.63
				4"	-	100	-		2	18.2	32	0.03281	49.88
				3"	-	75	-		5	18.2	21	0.02238	30.37
				1.5"	-	37.5	-		15	18.3	16	0.01331	21.54
3/4"	-	19	100.0	30	18.6	14	0.00949		18.10				
3/8"	15.99	9.5	99.9	60	19.1	12	0.00675		14.75				
No.4	-	4.75	99.9	<=Split hyd.	120	20.1	11	0.00474	13.36				
No.10	0.01	2	99.9		250	21.4	9.5	0.00326	11.21				
No.20	0.15	0.85	99.7		453	22.8	9	0.00239	10.86				
No.40	0.40	0.425	99.2		1477	22.8	8	0.00133	9.09				
No.60	0.67	0.25	98.7										
No.100	1.06	0.15	98.0										
No.140	1.82	0.106	96.7										
No.200	3.67	0.075	93.4										



Particle-Size Analysis of Soils with hydrometer

(ASTM D422)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/18/2013

By: BRR

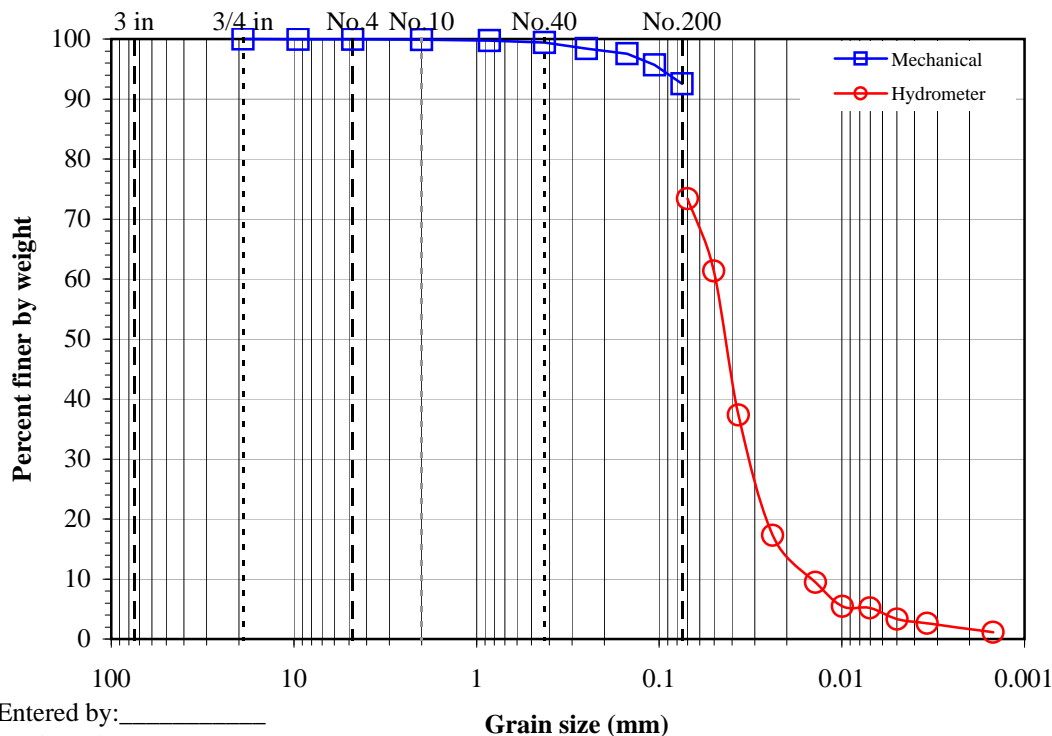
Boring No.: WUA-TP010-01

Sample:

Depth: 1-10'

Description: Brown silt

<div>Split sieve: Yes</div> <div>Split sieve: 3/8"</div> <div>Moist Dry</div> <div>Total sample wt. (g): 21537.22 20320.52</div> <div>+3/8" Coarse fraction (g): 16.12 15.99</div> <div>-3/8" Split fraction (g): 373.84 373.84</div> <div>Hydrometer fraction (g): 25.32 24.95</div> <div>Split fraction: 0.999</div>				<div>Water content data</div> <div>C.F.(+3/8") S.F.(-3/8") Hyd.(+No.10) Hyd.(-No.10)</div> <div>Moist soil + tare (g): 140.19 485.30 36.95 60.98</div> <div>Dry soil + tare (g): 140.06 464.88 36.95 60.64</div> <div>Tare (g): 124.07 124.07 36.93 37.60</div> <div>Water content (%): 0.81 5.99 0.00 1.48</div>									
				<div>Hydrometer data</div> <div>Slope: -0.1641</div> <div>Hyd. split: No.10 Intercept: 16.3</div> <div>Gs: 2.65 Assumed α: 1.00</div> <div>Bulb No. 2 Hyd. fraction: 99.92</div> <div>Vacuum period (min): 10 Dispersion device: None</div>									
				Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	<=Split	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
				8"	-	200	-		0.5	20.7	18	0.06991	73.36
				6"	-	150	-		1	20.7	15	0.05034	61.35
				4"	-	100	-		2	20.7	9	0.03684	37.32
				3"	-	75	-		5	20.7	4	0.02394	17.30
1.5"	-	37.5	-	15	20.8	2	0.01395		9.42				
3/4"	-	19	100.0	30	20.8	1	0.00991		5.42				
3/8"	15.99	9.5	99.9	<=Split hyd.	60	20.6	1	0.00703	5.15				
No.4	-	4.75	99.9	120	20.7	0.5	0.00497	3.28					
No.10	0.01	2	99.9	250	21.7	0	0.00341	2.62					
No.20	0.05	0.85	99.7	1363	20.6	0	0.00148	1.15					
No.40	0.13	0.425	99.4										
No.60	0.38	0.25	98.4										
No.100	0.59	0.15	97.6										
No.140	1.06	0.106	95.7										
No.200	1.85	0.075	92.5										



Gravel (%): 0.1
Sand (%): 7.4
Fines (%): 92.5

Comments:
 Vacuum applied and no flocculating agent used.

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP001-01

Sample:

Depth: 1-10'

Sample Description: Brown silty clay

Engineering Classification: Not requested

Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 61.86

Dry soil + tare (g) 58.92

Tare (g) 37.78

Water content, w (%) 13.9

Initial water temperature: 20.1 °C

Date test started: 11/20/2013

Time at beginning of test: 9:31

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	2	20.2	2	19.6	2	19.4
2	2	20	2	19.3	2	19.5
3	1	19.5	1	18.8	2	20
4	1	19.7	1	19	2	20.2

Dispersive classification: Grade 2-Intermediate

Entered: _____

Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP002-01
Sample:
Depth: 1-10'
Sample Description: Brown clay
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 51.71

Dry soil + tare (g) 49.86

Tare (g) 36.95

Water content, w (%) 14.3

Initial water temperature: 20 °C

Date test started: 11/20/2013

Time at beginning of test: 9:32

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	2	20	2	19.2	2	19.6
2	2	20	2	19.2	2	19.6
3	1	19.5	1	18.9	2	19.9
4	2	19.7	2	19	2	20

Dispersive classification: Grade 2-Intermediate

Entered: _____

Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP003-01
Sample:
Depth: 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 76.19

Dry soil + tare (g) 74.20

Tare (g) 37.76

Water content, w (%) 5.5

Initial water temperature: 19.9 °C

Date test started: 11/20/2013

Time at beginning of test: 9:32

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	3	19.9	3	19.1	2	19.5
2	3	20	3	19.1	2	19.7
3	1	20.1	1	19.3	1	18.5
4	1	20	1	19.2	1	18.5

Dispersive classification: Grade 3-Dispersive

Entered: _____

Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP004-01
Sample:
Depth: 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 59.79

Dry soil + tare (g) 58.67

Tare (g) 37.72

Water content, w (%) 5.3

Initial water temperature: 19.6 °C

Date test started: 11/21/2013

Time at beginning of test: 9:06

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	19.7	2	18.1	1	18.3
2	2	19.6	1	18	1	18.3

Dispersive classification: Grade 1-Nondispersive

Entered: _____
Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP005-01
Sample:
Depth: 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 63.86

Dry soil + tare (g) 62.44

Tare (g) 37.70

Water content, w (%) 5.7

Initial water temperature: 19.5 °C

Date test started: 11/21/2013

Time at beginning of test: 9:06

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	19.5	1	17.8	1	18.3
2	2	19.5	1	17.9	1	18.3

Dispersive classification: Grade 1-Nondispersive

Entered: _____

Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP006-01

Sample:

Depth: 1-10'

Sample Description: Brown silty clay

Engineering Classification: Not requested

Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 61.25

Dry soil + tare (g) 59.25

Tare (g) 37.25

Water content, w (%) 9.1

Initial water temperature: 19.6 °C

Date test started: 11/21/2013

Time at beginning of test: 9:06

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	2	19.5	2	18	2	18.3
2	3	19.6	3	18	3	18.3

Dispersive classification: Grade 3-Dispersive

Entered: _____

Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP007-01

Sample:

Depth: 1-10'

Sample Description: Brown silt

Engineering Classification: Not requested

Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 68.30

Dry soil + tare (g) 65.27

Tare (g) 37.59

Water content, w (%) 10.9

Initial water temperature: 19 °C

Date test started: 11/22/2013

Time at beginning of test: 8:58

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	18.9	1	18.4	1	18.2
2	2	19	2	18.3	2	18.4

Dispersive classification: Grade 2-Intermediate

Entered: _____

Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP008-01
Sample:
Depth: 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 63.64

Dry soil + tare (g) 62.32

Tare (g) 37.82

Water content, w (%) 5.4

Initial water temperature: 19.1 °C

Date test started: 11/22/2013

Time at beginning of test: 8:58

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	3	19.1	3	18.3	3	18.2
2	1	19	1	18.4	1	18.2

Dispersive classification: Grade 2-Intermediate

Entered: _____

Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP009-01
Sample:
Depth: 1-10'
Sample Description: Brown silty clay
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 55.50

Dry soil + tare (g) 54.17

Tare (g) 38.14

Water content, w (%) 8.3

Initial water temperature: 19 °C

Date test started: 11/22/2013

Time at beginning of test: 8:58

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	19	1	18.4	1	18.2
2	1	19	1	18.4	1	18.2

Dispersive classification: Grade 1-Nondispersive

Entered: _____
 Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: MWH
No: 00303-014
Location: FMC RDRA Data Gap Investigation
Date: 12/3/2013
By: BRR

Boring No.: WUA-TP010-01
Sample:
Depth: 1-10'
Sample Description: Brown silt
Engineering Classification: Not requested
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs: 2.65 Assumed

Curing Time: 0 minutes

Water used: Distilled

Water content: Natural

Wet soil + tare (g) 55.73

Dry soil + tare (g) 54.92

Tare (g) 37.60

Water content, w (%) 4.7

Initial water temperature: 19.8 °C

Date test started: 11/26/2013

Time at beginning of test: 8:58

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	20	1	19.1	1	20.7
2	1	19.7	1	19	1	20

Dispersive classification: Grade 1-Nondispersive

Entered: _____
 Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/21/2013**

By: **MP**

Method: **ASTM D698 B**

Mold Id. **Inc 2**

Mold volume (ft³): **0.0332**

Boring No.: **WUA-TP001-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silty clay**

Engineering Classification: **Not requested**

As-received water content (%): **Not requested**

Preparation method: **Moist**

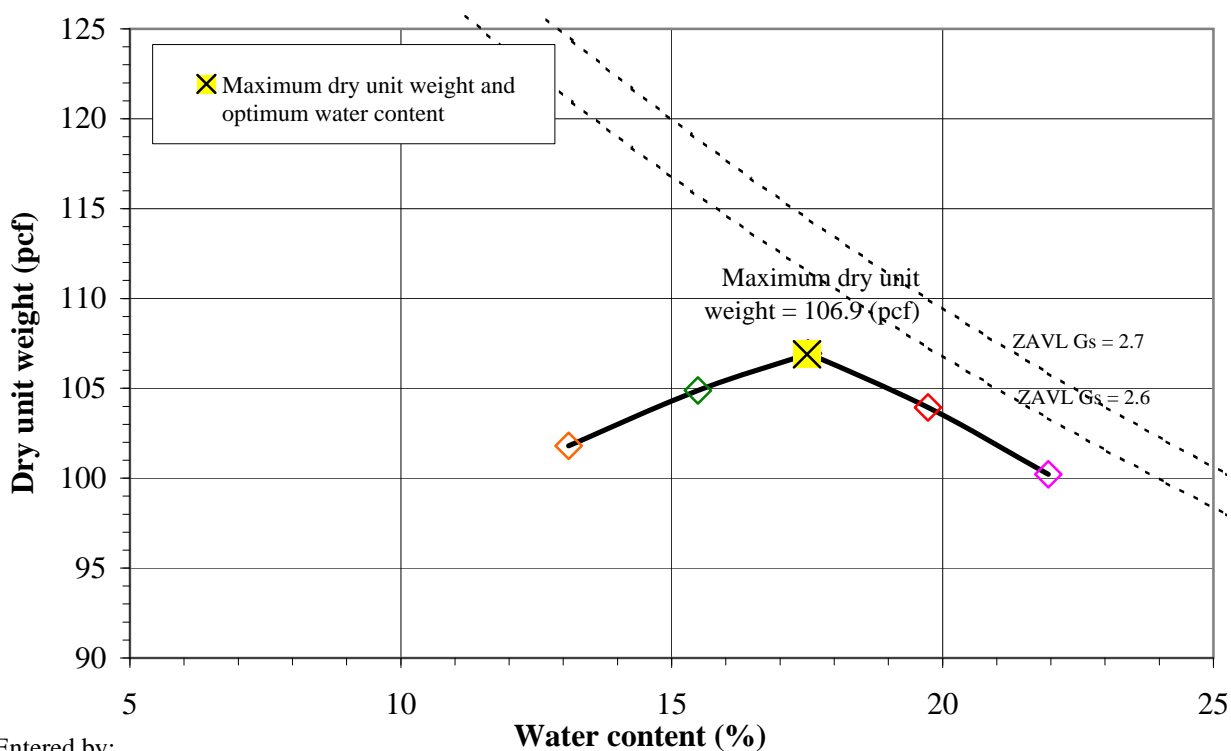
Rammer: **Mechanical-circular face**

Rock Correction: **No**

Optimum water content (%): **17.5**

Maximum dry unit weight (pcf): **106.9**

Point Number	+4%	+6%	+2%	+8%	As Is			
Wt. Sample + Mold (g)	6055.2	6036.4	5986.4	6003.0	5896.2			
Wt. of Mold (g)	4160.1	4160.1	4160.1	4160.1	4160.1			
Wet Unit Wt., γ_m (pcf)	125.7	124.4	121.1	122.2	115.1			
Wet Soil + Tare (g)	565.86	646.42	627.72	578.78	537.19			
Dry Soil + Tare (g)	499.95	563.05	560.18	497.56	489.13			
Tare (g)	123.73	140.46	123.93	127.54	122.22			
Water Content, w (%)	17.5	19.7	15.5	22.0	13.1			
Dry Unit Wt., γ_d (pcf)	106.9	103.9	104.9	100.2	101.8			



Entered by: _____

Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/21/2013**

By: **DKS**

Method: **ASTM D698 B**

Mold Id. **Inc 2**

Mold volume (ft³): **0.0332**

Boring No.: **WUA-TP002-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown clay**

Engineering Classification: **Not requested**

As-received water content (%): **Not requested**

Preparation method: **Moist**

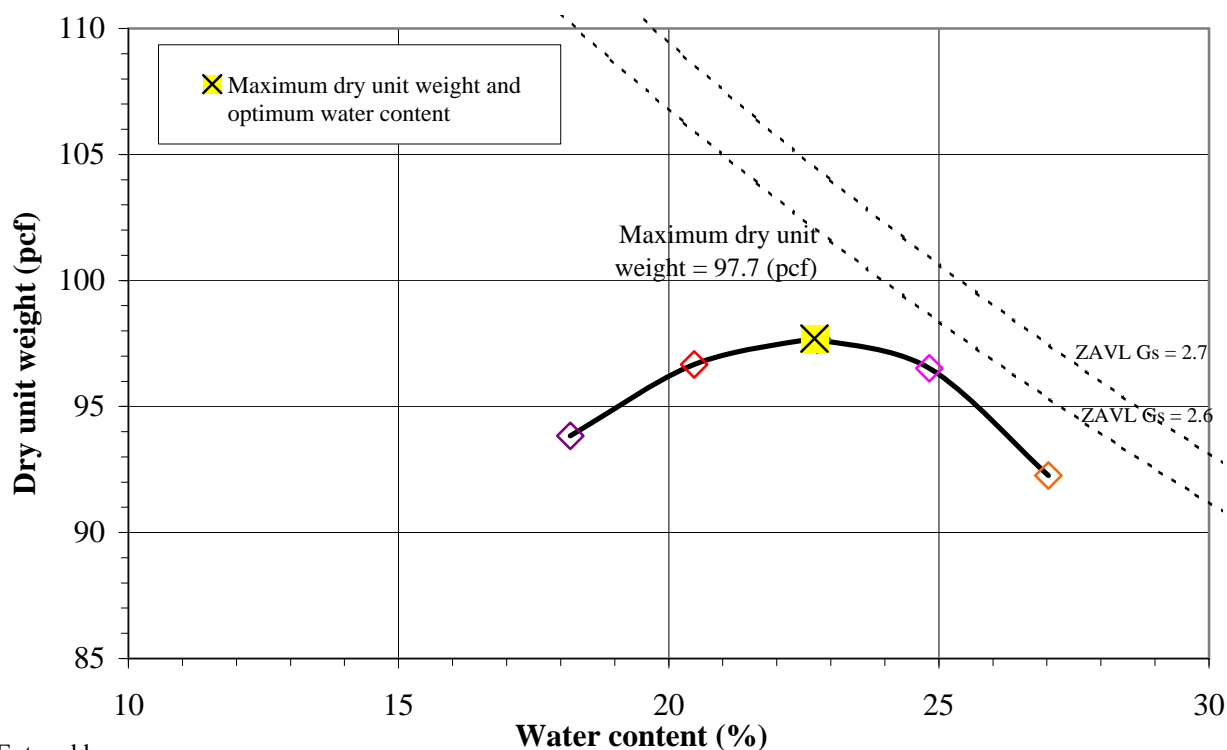
Rammer: **Mechanical-circular face**

Rock Correction: **No**

Optimum water content (%): **22.7**

Maximum dry unit weight (pcf): **97.7**

Point Number	+4%	+6%	+8%	+10%	+12%			
Wt. Sample + Mold (g)	5832.2	5916.0	5967.7	5976.6	5927.2			
Wt. of Mold (g)	4160.1	4160.1	4160.1	4160.1	4160.1			
Wet Unit Wt., γ_m (pcf)	110.9	116.5	119.9	120.5	117.2			
Wet Soil + Tare (g)	629.80	842.24	824.58	833.17	945.37			
Dry Soil + Tare (g)	551.61	723.01	694.50	691.81	790.71			
Tare (g)	121.43	140.49	122.65	122.35	218.49			
Water Content, w (%)	18.2	20.5	22.7	24.8	27.0			
Dry Unit Wt., γ_d (pcf)	93.8	96.7	97.7	96.5	92.3			



Entered by: _____

Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/21/2013**

By: **MP/DKS**

Method: **ASTM D698 B**

Mold Id. **Inc 2**

Mold volume (ft³): **0.0332**

Boring No.: **WUA-TP003-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silty clay**

Engineering Classification: **Not requested**

As-received water content (%): **Not requested**

Preparation method: **Moist**

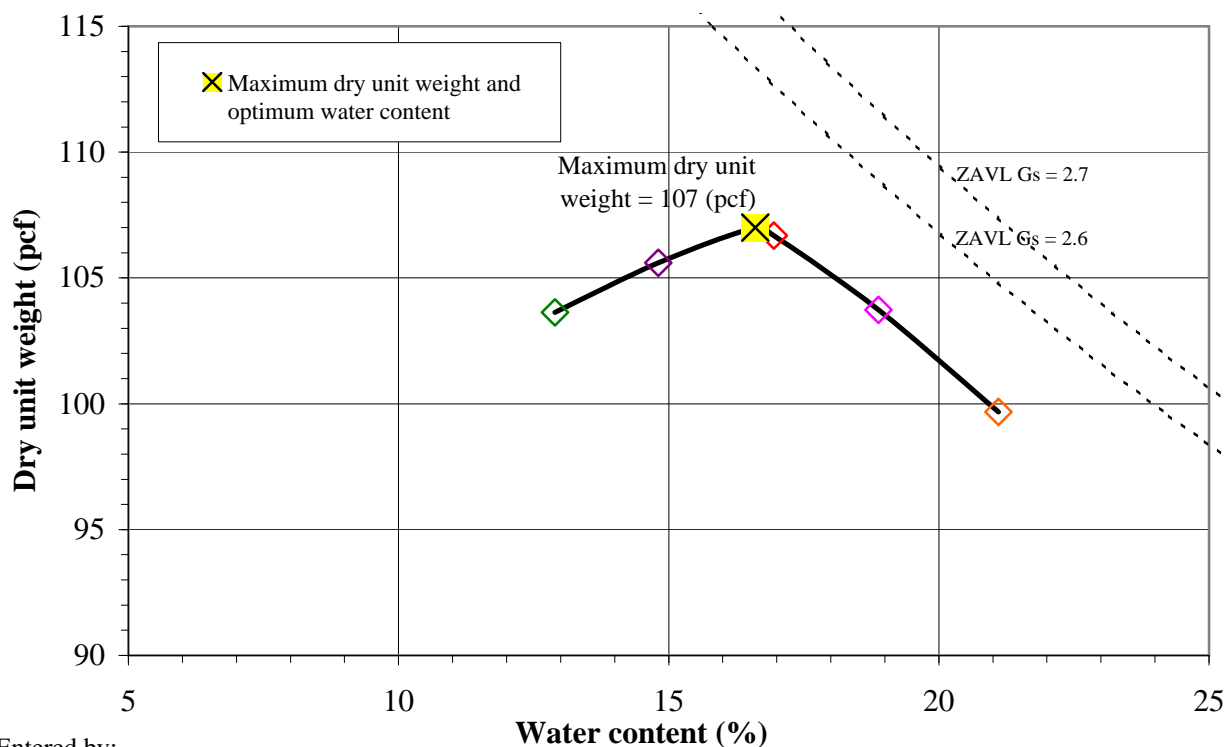
Rammer: **Mechanical-circular face**

Rock Correction: **No**

Optimum water content (%): **16.6**

Maximum dry unit weight (pcf): **107**

Point Number	+8%	+10%	+6%	+12%	+14%			
Wt. Sample + Mold (g)	5988.2	6041.3	5924.3	6019.6	5980.3			
Wt. of Mold (g)	4160.1	4160.1	4160.1	4160.1	4160.1			
Wet Unit Wt., γ_m (pcf)	121.2	124.8	117.0	123.3	120.7			
Wet Soil + Tare (g)	866.98	843.94	686.43	765.24	862.82			
Dry Soil + Tare (g)	770.44	740.20	622.12	665.90	734.68			
Tare (g)	118.56	127.94	123.43	139.73	127.41			
Water Content, w (%)	14.8	16.9	12.9	18.9	21.1			
Dry Unit Wt., γ_d (pcf)	105.6	106.7	103.6	103.7	99.7			



Entered by: _____

Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/21/2013**

By: **MP/DKS**

Method: **ASTM D698 B**

Mold Id. **Inc 2**

Mold volume (ft³): **0.0332**

Boring No.: **WUA-TP004-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silt**

Engineering Classification: **Not requested**

As-received water content (%): **Not requested**

Preparation method: **Moist**

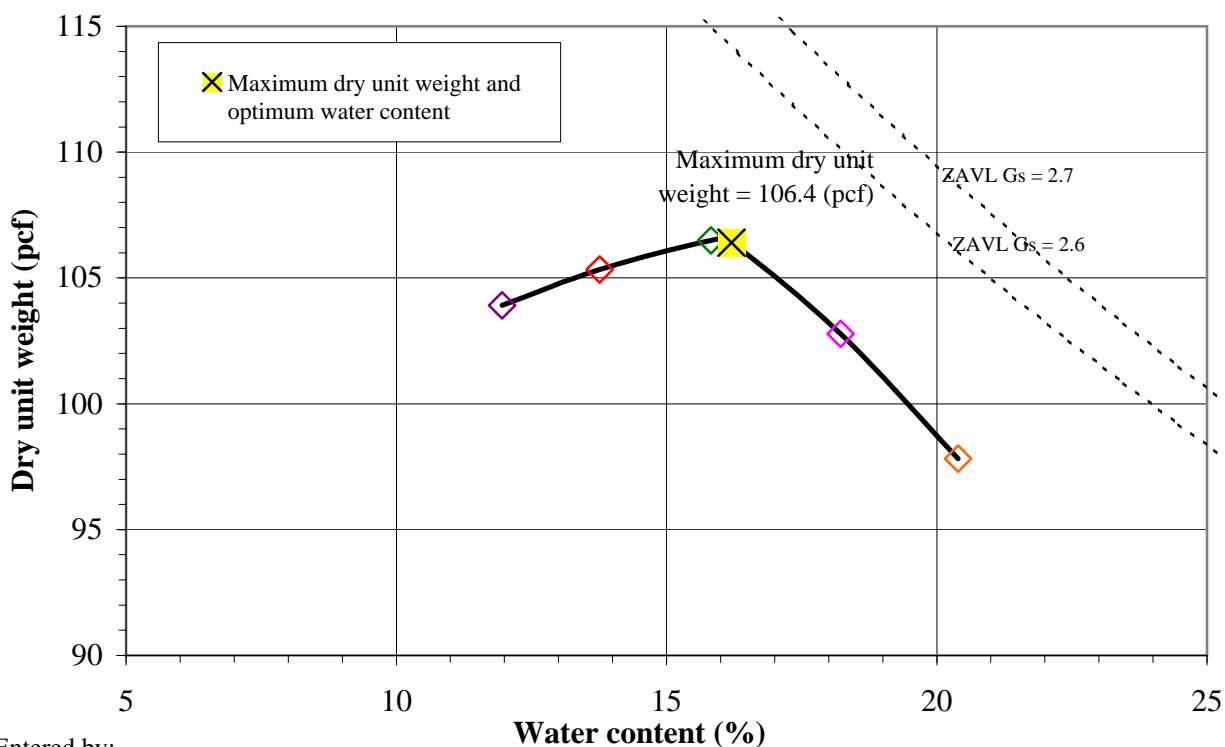
Rammer: **Mechanical-circular face**

Rock Correction: **No**

Optimum water content (%): **16.2**

Maximum dry unit weight (pcf): **106.4**

Point Number	+6%	+8%	+10%	+12%	+14%			
Wt. Sample + Mold (g)	5914.3	5967.1	6019.8	5992.2	5936.0			
Wt. of Mold (g)	4160.1	4160.1	4160.1	4160.1	4160.1			
Wet Unit Wt., γ_m (pcf)	116.3	119.8	123.3	121.5	117.8			
Wet Soil + Tare (g)	793.31	785.16	729.94	720.77	811.93			
Dry Soil + Tare (g)	721.64	705.54	647.18	631.53	704.92			
Tare (g)	122.18	127.09	124.09	141.72	180.27			
Water Content, w (%)	12.0	13.8	15.8	18.2	20.4			
Dry Unit Wt., γ_d (pcf)	103.9	105.3	106.5	102.8	97.8			



Entered by: _____

Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/21/2013

By: BRR/DKS

Method: ASTM D698 B

Mold Id. Inc 3

Mold volume (ft³): 0.0332

Boring No.: WUA-TP005-01

Sample:

Depth: 1-10'

Sample Description: Brown silt

Engineering Classification: Not requested

As-received water content (%): Not requested

Preparation method: Moist

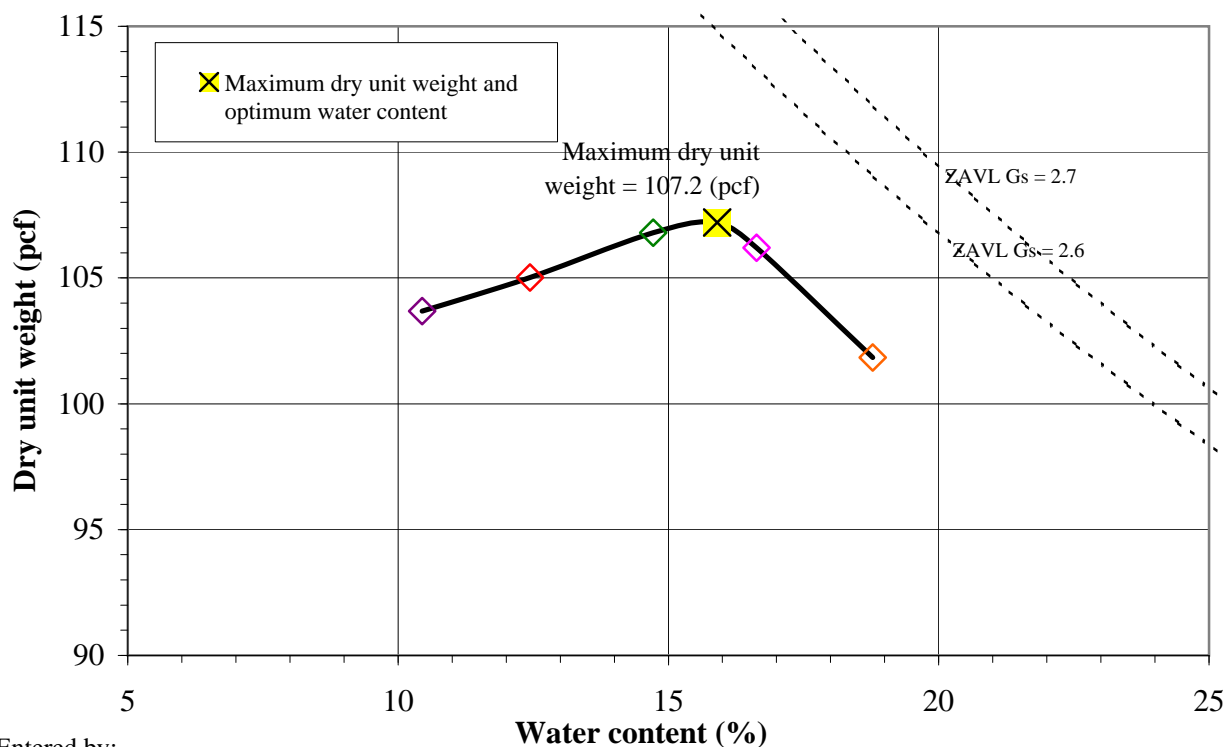
Rammer: Mechanical-circular face

Rock Correction: No

Optimum water content (%): 15.9

Maximum dry unit weight (pcf): 107.2

Point Number	+4%	+6%	+8%	+10%	+12%			
Wt. Sample + Mold (g)	5895.4	5949.1	6015.9	6036.1	5992.4			
Wt. of Mold (g)	4169.7	4169.7	4169.7	4169.7	4169.7			
Wet Unit Wt., γ_m (pcf)	114.5	118.1	122.5	123.9	121.0			
Wet Soil + Tare (g)	877.44	816.01	868.81	804.39	907.87			
Dry Soil + Tare (g)	815.25	750.77	784.50	715.24	784.48			
Tare (g)	219.83	226.30	211.70	179.20	127.34			
Water Content, w (%)	10.4	12.4	14.7	16.6	18.8			
Dry Unit Wt., γ_d (pcf)	103.7	105.0	106.8	106.2	101.8			



Entered by: _____

Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/8/2013**

By: **ET**

Method: **ASTM D698 B**

Mold Id. **Inc 1**

Mold volume (ft³): **0.0333**

Boring No.: **WUA-TP006-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silty clay**

Engineering Classification: **Not requested**

As-received water content (%): **Not requested**

Preparation method: **Moist**

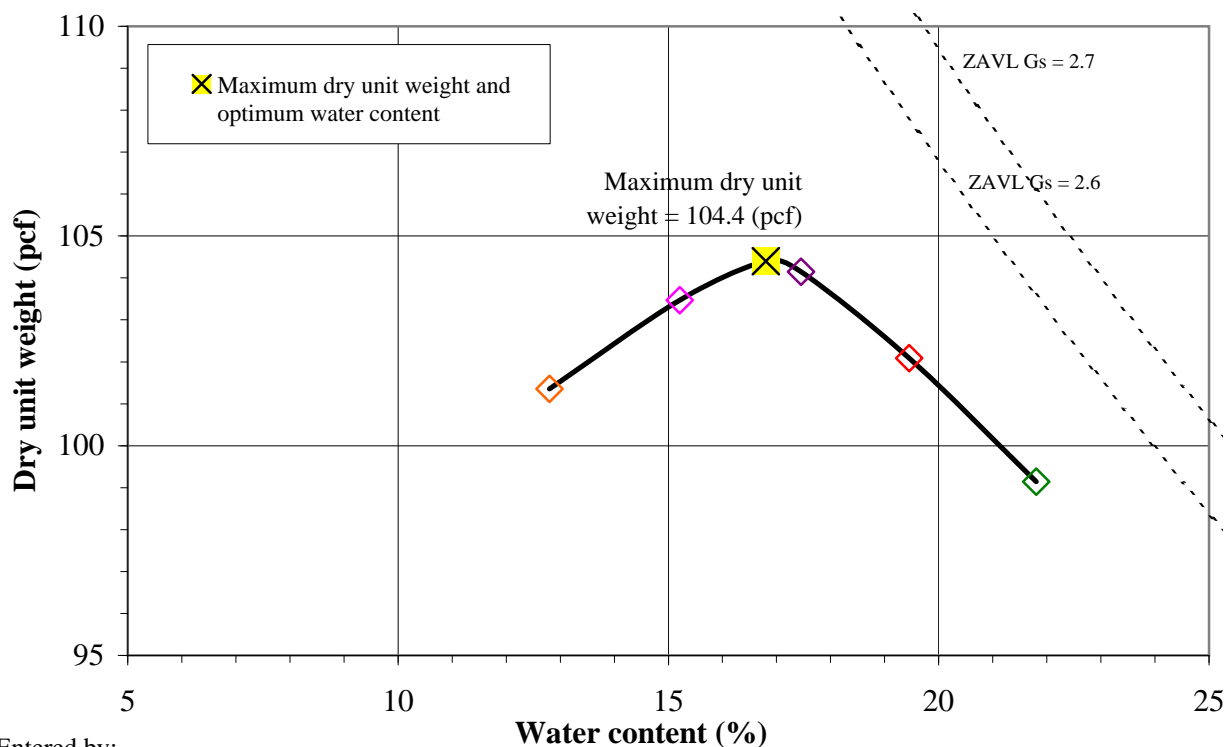
Rammer: **Mechanical-circular face**

Rock Correction: **No**

Optimum water content (%): **16.8**

Maximum dry unit weight (pcf): **104.4**

Point Number	+4%	+6%	+8%	+2%	As Is			
Wt. Sample + Mold (g)	6092.6	6086.9	6068.9	6045.5	5971.9			
Wt. of Mold (g)	4245.5	4245.5	4245.5	4245.5	4245.5			
Wet Unit Wt., γ_m (pcf)	122.3	121.9	120.8	119.2	114.3			
Wet Soil + Tare (g)	722.48	636.60	623.79	729.81	633.94			
Dry Soil + Tare (g)	633.59	553.79	539.10	662.84	575.98			
Tare (g)	124.34	128.08	150.65	222.53	123.25			
Water Content, w (%)	17.5	19.5	21.8	15.2	12.8			
Dry Unit Wt., γ_d (pcf)	104.1	102.1	99.1	103.5	101.4			



Entered by: _____

Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

Date: 11/8/2013

By: ET

Method: ASTM D698 B

Mold Id. Inc 3

Mold volume (ft³): 0.0332

Boring No.: WUA-TP007-01

Sample:

Depth: 1-10'

Sample Description: Brown silt

Engineering Classification: Not requested

As-received water content (%): Not requested

Preparation method: Moist

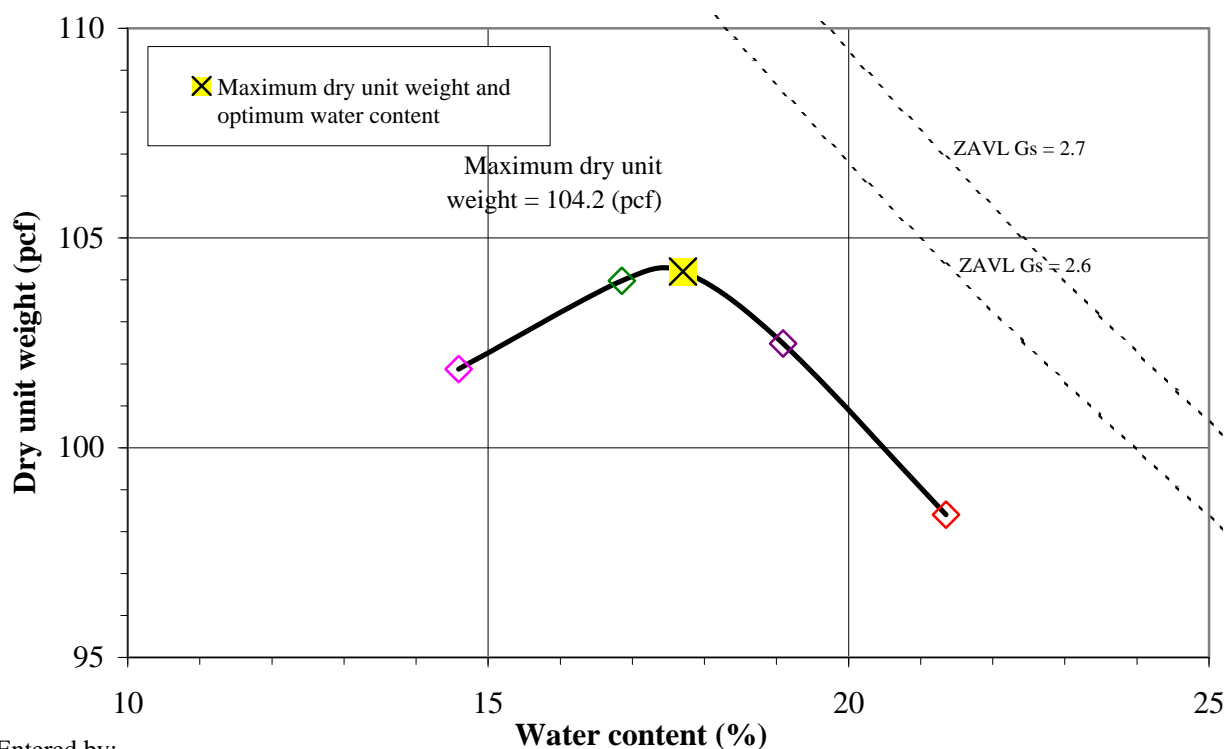
Rammer: Mechanical-circular face

Rock Correction: No

Optimum water content (%): 17.7

Maximum dry unit weight (pcf): 104.2

Point Number	+10%	+12%	+8%	+6%				
Wt. Sample + Mold (g)	6008.9	5969.1	6000.7	5928.8				
Wt. of Mold (g)	4169.7	4169.7	4169.7	4169.7				
Wet Unit Wt., γ_m (pcf)	122.1	119.4	121.5	116.7				
Wet Soil + Tare (g)	750.80	683.42	649.06	663.82				
Dry Soil + Tare (g)	664.27	594.80	573.97	595.63				
Tare (g)	210.99	179.73	128.42	128.20				
Water Content, w (%)	19.1	21.4	16.9	14.6				
Dry Unit Wt., γ_d (pcf)	102.5	98.4	104.0	101.9				



Entered by: _____

Reviewed: _____

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Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/11/2013**

By: **MP**

Method: **ASTM D698 B**

Mold Id. **Inc 1**

Mold volume (ft³): **0.0333**

Boring No.: **WUA-TP008-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silt**

Engineering Classification: **Not requested**

As-received water content (%): **Not requested**

Preparation method: **Moist**

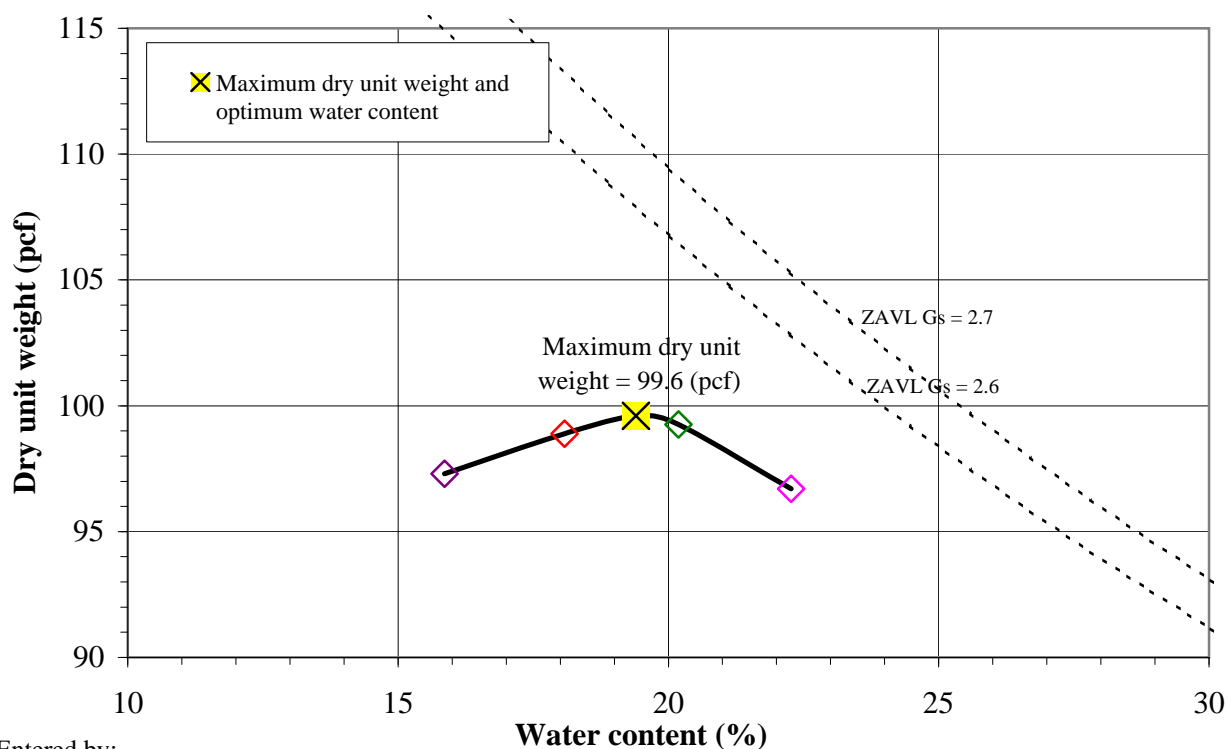
Rammer: **Mechanical-circular face**

Rock Correction: **No**

Optimum water content (%): **19.4**

Maximum dry unit weight (pcf): **99.6**

Point Number	+6%	+8%	+10%	+12%				
Wt. Sample + Mold (g)	5947.5	6008.6	6046.7	6030.8				
Wt. of Mold (g)	4245.4	4245.4	4245.4	4245.4				
Wet Unit Wt., γ_m (pcf)	112.7	116.8	119.3	118.2				
Wet Soil + Tare (g)	793.10	730.81	657.43	631.47				
Dry Soil + Tare (g)	702.11	637.30	567.80	538.32				
Tare (g)	128.38	120.00	123.83	120.08				
Water Content, w (%)	15.9	18.1	20.2	22.3				
Dry Unit Wt., γ_d (pcf)	97.3	98.9	99.3	96.7				



Entered by: _____

Reviewed: _____

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Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/11/2013**

By: **MP**

Method: **ASTM D698 B**

Mold Id. **Inc 1**

Mold volume (ft³): **0.0333**

Boring No.: **WUA-TP009-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silty clay**

Engineering Classification: **Not requested**

As-received water content (%): **Not requested**

Preparation method: **Moist**

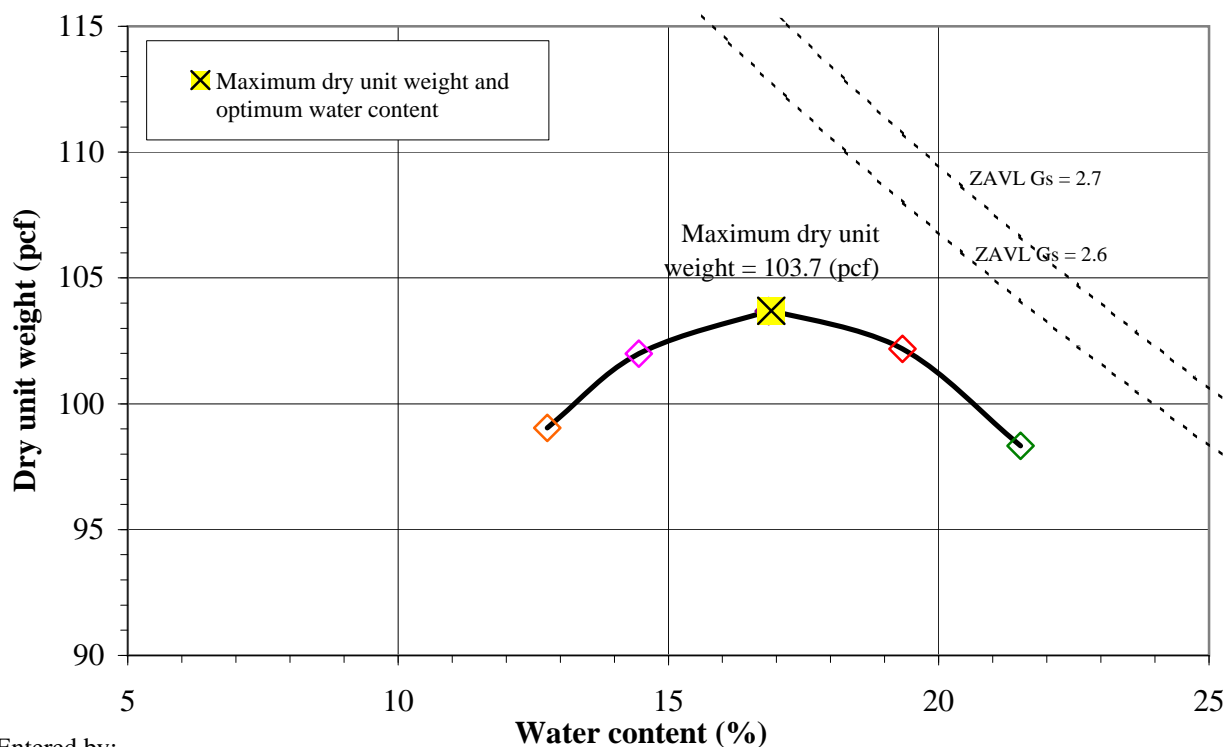
Rammer: **Mechanical-circular face**

Rock Correction: **No**

Optimum water content (%): **16.9**

Maximum dry unit weight (pcf): **103.7**

Point Number	+8%	+10%	+12%	+6%	+4%			
Wt. Sample + Mold (g)	6074.9	6086.5	6049.5	6008.0	5931.7			
Wt. of Mold (g)	4245.4	4245.4	4245.4	4245.4	4245.4			
Wet Unit Wt., γ_m (pcf)	121.2	121.9	119.5	116.7	111.7			
Wet Soil + Tare (g)	596.34	653.19	684.40	585.10	677.28			
Dry Soil + Tare (g)	528.63	567.41	584.85	527.23	626.00			
Tare (g)	126.90	123.67	122.09	126.80	224.06			
Water Content, w (%)	16.9	19.3	21.5	14.5	12.8			
Dry Unit Wt., γ_d (pcf)	103.7	102.2	98.3	102.0	99.0			



Entered by: _____

Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)



© IGES 2004, 2013

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/11/2013**

By: **MP**

Method: **ASTM D698 B**

Mold Id. **Inc 1**

Mold volume (ft³): **0.0333**

Boring No.: **WUA-TP010-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silt**

Engineering Classification: **Not requested**

As-received water content (%): **Not requested**

Preparation method: **Moist**

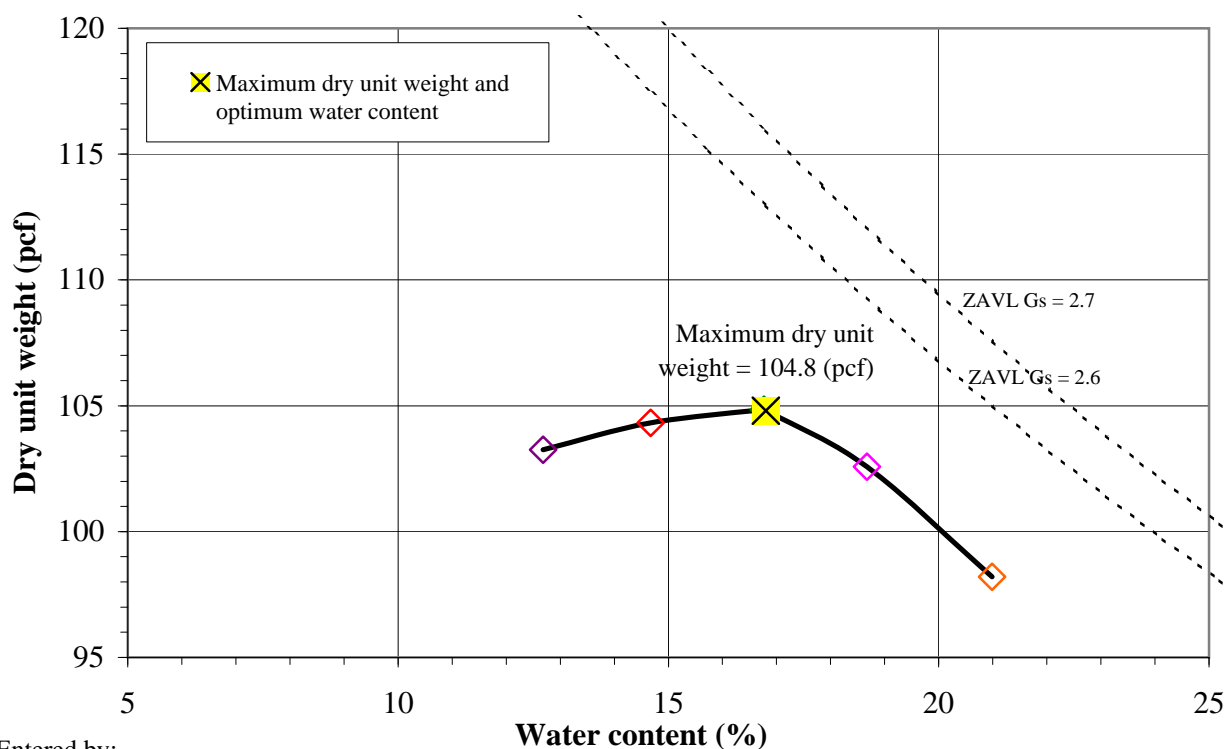
Rammer: **Mechanical-circular face**

Rock Correction: **No**

Optimum water content (%): **16.8**

Maximum dry unit weight (pcf): **104.8**

Point Number	+6%	+8%	+10%	+12%	+14%			
Wt. Sample + Mold (g)	6002.2	6051.8	6093.8	6083.6	6039.4			
Wt. of Mold (g)	4245.4	4245.4	4245.4	4245.4	4245.4			
Wet Unit Wt., γ_m (pcf)	116.3	119.6	122.4	121.7	118.8			
Wet Soil + Tare (g)	609.52	667.87	818.15	672.08	834.00			
Dry Soil + Tare (g)	554.23	598.85	718.44	586.69	726.05			
Tare (g)	118.33	128.44	123.65	129.44	211.70			
Water Content, w (%)	12.7	14.7	16.8	18.7	21.0			
Dry Unit Wt., γ_d (pcf)	103.3	104.3	104.8	102.6	98.2			



Entered by: _____

Reviewed: _____

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Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/19/2013**

By: **JDF**

Boring No.: **WUA-TP001-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silty clay**

Sample Type: **Laboratory Compacted**

Compaction Specifications: **85** (%) Dry unit weight
at **8.5** (%) w

Optimum water content (%) **17.5**

Maximum dry unit weight (pcf) **106.9**

Gs **2.67** Assumed

Cell No. **2**

Station No. **1**

Permeant liquid used **De-aired tap water**

Total backpressure (psi) **30**

Effective horiz. consolidation stress (psi) **5**

Effective vert. consolidation stress (psi) **5**

	Initial (o)	Final (f)
Sample Height, H (in)	3.012	3.006
Sample Diameter, D (in)	2.406	2.39
Sample Length, L (cm)	7.650	7.634
Sample Area, A (cm^2)	29.332	29.017
Sample Volume, V (cm^3)	224.41	221.52
Wt. Rings + Wet Soil (g)	354.02	423.13
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	98.5	119.2
Wet Soil + Tare (g)	251.73	551.68
Dry Soil + Tare (g)	242.16	455.37
Tare (g)	126.81	128.2
Weight of solids, Ws (g)	326.90	326.90
Water Content, w (%)	8.30	29.44
Dry Unit Wt, γ_d (pcf)	90.9	92.1
Void ratio, e, for assumed Gs	0.83	0.79
Saturation (%), for assumed Gs	26.6	100 ^a
Average K^b (cm/sec)	3.3E-05	
^a Saturation set to 100% for phase calculations		
^b K corrected to 20°C		

	Initial (o)	Final (f)
B value	0.86	0.96
External Burette (cm ³)	8.30	16.70
Cell Pressure (psi)	0.0	35.0

Backpressure bottom (psi) **30.0**

Backpressure top (psi) **30.0**

System volume coefficient (cm³/psi) **0.158**

System volume change (cm³) **5.52**

Net sample volume change (cm³) **-2.88**

Bottom burette ground length, l_b (cm) **82.00**

Top burette ground length, l_t (cm) **82.1**

Burette area, a (cm²) **0.197**

Conversion, reading to cm head (cm/rd) **5.076**

Start Date and Time: 11/15/13 9:11								
Elapsed time (sec)	Bottom Burette (cm ³)	Top Burette (cm ³)	h ₁ (cm)	h ₂ (cm)	K (cm/sec)	Temp (°C)	Visc. Ratic R _f	K ^b (cm/sec)
1080.0	1.20	8.72	38.07	8.43	3.6E-05	22.4	0.94	3.4E-05
	4.12	5.80						
1260.0	0.38	9.62	46.80	8.12	3.6E-05	22.8	0.93	3.4E-05
	4.18	5.80						
1020.0	0.42	9.54	46.19	12.18	3.4E-05	21.5	0.96	3.3E-05
	3.78	6.20						
960.0	0.44	9.54	46.09	13.00	3.4E-05	21.5	0.96	3.3E-05
	3.70	6.28						
60.0	0.00	10.00	50.66	46.60	3.6E-05	22.6	0.94	3.4E-05
	0.40	9.60						
960.0	0.40	9.60	46.60	13.00	3.4E-05	22.6	0.94	3.2E-05
	3.70	6.28						

Entered by: _____

Reviewed: _____

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/19/2013**

By: **JDF**

Boring No.: **WUA-TP004-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silt**

Sample Type: **Laboratory Compacted**

Compaction Specifications: **85** (%) Dry unit weight
at **9.0** (%) w

Optimum water content (%) **16.2**

Maximum dry unit weight (pcf) **106.4**

Gs **2.67** Assumed

Cell No. **T1**

Station No. **2**

Permeant liquid used **De-aired tap water**

Total backpressure (psi) **30**

Effective horiz. consolidation stress (psi) **5**

Effective vert. consolidation stress (psi) **5**

	Initial (o)	Final (f)
Sample Height, H (in)	3.011	3.000
Sample Diameter, D (in)	2.403	2.38
Sample Length, L (cm)	7.648	7.619
Sample Area, A (cm^2)	29.259	28.709
Sample Volume, V (cm^3)	223.77	218.74
Wt. Rings + Wet Soil (g)	1111.29	423.74
Wt. Rings (g)	758.93	0
Wet Unit Wt., γ_m (pcf)	98.3	120.9
Wet Soil + Tare (g)	328.04	535.3
Dry Soil + Tare (g)	312.2	436.67
Tare (g)	139.72	121.57
Weight of solids, Ws (g)	322.72	322.72
Water Content, w (%)	9.18	31.30
Dry Unit Wt, γ_d (pcf)	90.0	92.1
Void ratio, e, for assumed Gs	0.85	0.84
Saturation (%), for assumed Gs	28.8	100 ^a
Average K ^b (cm/sec)	1.4E-04	
^a Saturation set to 100% for phase calculations		
^b K corrected to 20°C		

	Initial (o)	Final (f)
B value	0.94	0.98
External Burette (cm ³)	12.20	21.40
Cell Pressure (psi)	0.0	35.0

Backpressure bottom (psi) **30.0**

Backpressure top (psi) **30.0**

System volume coefficient (cm³/psi) **0.119**

System volume change (cm³) **4.17**

Net sample volume change (cm³) **-5.03**

Bottom burette ground length, l_b (cm) **81.99**

Top burette ground length, l_t (cm) **81.97**

Burette area, a (cm²) **0.197**

Conversion, reading to cm head (cm/rd) **5.076**

Start Date and Time: 11/18/13 8:40								
Elapsed time (sec)	Bottom Burette (cm ³)	Top Burette (cm ³)	h ₁ (cm)	h ₂ (cm)	K (cm/sec)	Temp (°C)	Visc. Ratic R _f	K ^b (cm/sec)
60.0	0.00 1.48	10.00 8.56	50.78	35.96	1.5E-04	22.0	0.95	1.4E-04
240.0	1.48 4.12	8.56 5.98	35.96	9.46	1.5E-04	22.1	0.95	1.4E-04
60.0	0.00 1.44	10.00 8.54	50.78	36.06	1.5E-04	21.0	0.98	1.5E-04
240.0	1.44 4.10	8.54 5.92	36.06	9.26	1.5E-04	20.8	0.98	1.5E-04
60.0	0.00 1.42	10.00 8.56	50.78	36.26	1.5E-04	22.9	0.93	1.4E-04
240.0	1.42 4.10	8.56 5.90	36.26	9.16	1.5E-04	21.9	0.95	1.4E-04

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Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/19/2013**

By: **JDF**

Boring No.: **WUA-TP006-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silty clay**

Sample Type: **Laboratory Compacted**

Compaction Specifications: **85** (%) Dry unit weight
at **8.5** (%) w

Optimum water content (%) **16.8**

Maximum dry unit weight (pcf) **104.4**

Gs **2.67** Assumed

Cell No. **T2**

Station No. **3**

Permeant liquid used **De-aired tap water**

Total backpressure (psi) **30**

Effective horiz. consolidation stress (psi) **5**

Effective vert. consolidation stress (psi) **5**

	Initial (o)	Final (f)
Sample Height, H (in)	3.014	2.996
Sample Diameter, D (in)	2.401	2.36
Sample Length, L (cm)	7.656	7.610
Sample Area, A (cm ²)	29.211	28.322
Sample Volume, V (cm ³)	223.62	215.51
Wt. Rings + Wet Soil (g)	346.12	411.81
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	96.6	119.3
Wet Soil + Tare (g)	304.54	534.21
Dry Soil + Tare (g)	289.91	440.58
Tare (g)	123.34	122.43
Weight of solids, W_s (g)	318.17	318.17
Water Content, w (%)	8.78	29.43
Dry Unit Wt., γ_d (pcf)	88.8	92.2
Void ratio, e, for assumed Gs	0.88	0.79
Saturation (%), for assumed Gs	26.8	100 ^a
Average K^b (cm/sec)	2.3E-05	

^a Saturation set to 100% for phase calculations

^b K corrected to 20°C

	Initial (o)	Final (f)
B value	0.88	0.96
External Burette (cm ³)	10.50	22.40
Cell Pressure (psi)	0.0	35.0

Backpressure bottom (psi) **30.0**

Backpressure top (psi) **30.0**

System volume coefficient (cm³/psi) **0.108**

System volume change (cm³) **3.79**

Net sample volume change (cm³) **-8.11**

Bottom burette ground length, l_b (cm) **82.10**

Top burette ground length, l_t (cm) **81.9**

Burette area, a (cm²) **0.197**

Conversion, reading to cm head (cm/rd) **5.076**

Start Date and Time: 11/15/13 9:12									
Elapsed time (sec)	Bottom Burette (cm ³)	Top Burette (cm ³)	h_1 (cm)	h_2 (cm)	K (cm/sec)	Temp (°C)	Visc. Ratio R_f	K ^b (cm/sec)	
180.0	0.00 0.76	10.00 9.20	50.96	43.04	2.5E-05	22.2	0.95	2.4E-05	
1080.0	0.76 3.42	9.20 6.54	43.04	16.04	2.4E-05	21.8	0.96	2.3E-05	
600.0	3.42 4.10	6.54 5.86	16.04	9.13	2.5E-05	21.2	0.97	2.4E-05	
60.0	0.00 0.28	10.00 9.78	50.96	48.42	2.3E-05	22.1	0.95	2.1E-05	
1320.0	0.28 3.56	9.78 6.54	48.42	15.33	2.3E-05	22.5	0.94	2.2E-05	
60.0	0.00 0.26	10.00 9.72	50.96	48.22	2.4E-05	21.0	0.98	2.4E-05	
900.0	0.26 2.86	9.72 7.12	48.22	21.82	2.3E-05	22.0	0.95	2.2E-05	

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Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/19/2013**

By: **JDF**

Boring No.: **WUA-TP007-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silt**

Sample Type: **Laboratory Compacted**

Compaction Specifications: **85** (%) Dry unit weight
at **8.5** (%) w

Optimum water content (%) **17.7**

Maximum dry unit weight (pcf) **104.2**

Gs **2.65** Assumed

Cell No. **T3**

Station No. **4**

Permeant liquid used **De-aired tap water**

Total backpressure (psi) **30**

Effective horiz. consolidation stress (psi) **5**

Effective vert. consolidation stress (psi) **5**

	Initial (o)	Final (f)
Sample Height, H (in)	3.007	2.993
Sample Diameter, D (in)	2.409	2.38
Sample Length, L (cm)	7.638	7.603
Sample Area, A (cm ²)	29.406	28.735
Sample Volume, V (cm ³)	224.59	218.48
Wt. Rings + Wet Soil (g)	345.51	418.30
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	96.0	119.5
Wet Soil + Tare (g)	304.93	545.67
Dry Soil + Tare (g)	291.11	446.57
Tare (g)	123	127.09
Weight of solids, W _s (g)	319.26	319.26
Water Content, w (%)	8.22	31.02
Dry Unit Wt., γ_d (pcf)	88.7	91.2
Void ratio, e, for assumed G _s	0.86	0.82
Saturation (%), for assumed G _s	25.2	100 ^a
Average K^b (cm/sec)	5.8E-05	

^a Saturation set to 100% for phase calculations

^b K corrected to 20°C

	Initial (o)	Final (f)
B value	0.84	1.00
External Burette (cm ³)	7.30	17.10
Cell Pressure (psi)	0.0	35.0

Backpressure bottom (psi) **30.0**

Backpressure top (psi) **30.0**

System volume coefficient (cm³/psi) **0.105**

System volume change (cm³) **3.69**

Net sample volume change (cm³) **-6.11**

Bottom burette ground length, l_b (cm) **81.90**

Top burette ground length, l_t (cm) **81.98**

Burette area, a (cm²) **0.197**

Conversion, reading to cm head (cm/rd) **5.076**

Start Date and Time: 11/15/13 9:34								
Elapsed time (sec)	Bottom Burette (cm ³)	Top Burette (cm ³)	h ₁ (cm)	h ₂ (cm)	K (cm/sec)	Temp (°C)	Visc. Ratic R _f	K ^b (cm/sec)
600.0	0.90 3.96	9.14 6.12	41.75	10.88	5.8E-05	21.6	0.96	5.6E-05
660.0	0.80 4.04	9.20 6.00	42.56	9.87	5.8E-05	22.5	0.94	5.4E-05
60.0	0.00 0.70	10.00 9.30	50.68	43.57	6.6E-05	22.5	0.94	6.2E-05
600.0	0.70 3.94	9.30 6.04	43.57	10.58	6.1E-05	22.5	0.94	5.8E-05
60.0	0.00 0.72	10.00 9.38	50.68	43.88	6.3E-05	22.6	0.94	5.9E-05
600.0	0.72 4.00	9.38 5.90	43.88	9.56	6.6E-05	22.6	0.94	6.2E-05

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Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)



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Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **11/19/2013**

By: **JDF**

Boring No.: **WUA-TP008-01**

Sample:

Depth: **1-10'**

Sample Description: **Brown silt**

Sample Type: **Laboratory Compacted**

Compaction Specifications: **85** (%) Dry unit weight
at **8.5** (%) w

Optimum water content (%) **19.4**

Maximum dry unit weight (pcf) **99.6**

Gs **2.65** Assumed

Cell No. **3**

Station No. **5**

Permeant liquid used **De-aired tap water**

Total backpressure (psi) **30**

Effective horiz. consolidation stress (psi) **5**

Effective vert. consolidation stress (psi) **5**

	Initial (o)	Final (f)
Sample Height, H (in)	3.010	2.998
Sample Diameter, D (in)	2.405	2.38
Sample Length, L (cm)	7.645	7.615
Sample Area, A (cm^2)	29.308	28.727
Sample Volume, V (cm^3)	224.07	218.77
Wt. Rings + Wet Soil (g)	330.21	410.65
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	92.0	117.2
Wet Soil + Tare (g)	379.66	536.54
Dry Soil + Tare (g)	360.76	430.39
Tare (g)	140.47	127.37
Weight of solids, Ws (g)	304.12	304.12
Water Content, w (%)	8.58	35.03
Dry Unit Wt, γ_d (pcf)	84.7	86.8
Void ratio, e, for assumed Gs	0.95	0.93
Saturation (%), for assumed Gs	23.9	100 ^a
Average K^b (cm/sec)	7.8E-05	
^a Saturation set to 100% for phase calculations		
^b K corrected to 20°C		

	Initial (o)	Final (f)
B value	0.86	0.98
External Burette (cm ³)	12.60	23.20
Cell Pressure (psi)	0.0	35.0

Backpressure bottom (psi) **30.0**

Backpressure top (psi) **30.0**

System volume coefficient (cm³/psi) **0.151**

System volume change (cm³) **5.29**

Net sample volume change (cm³) **-5.31**

Bottom burette ground length, l_b (cm) **81.85**

Top burette ground length, l_t (cm) **81.9**

Burette area, a (cm²) **0.197**

Conversion, reading to cm head (cm/rd) **5.076**

Start Date and Time: 11/15/13 9:35								
Elapsed time (sec)	Bottom Burette (cm ³)	Top Burette (cm ³)	h ₁ (cm)	h ₂ (cm)	K (cm/sec)	Temp (°C)	Visc. Ratic R _f	K ^b (cm/sec)
420.0	1.68 4.12	8.30 5.84	33.55	8.68	8.4E-05	21.0	0.98	8.2E-05
480.0	0.96 4.10	9.06 5.94	41.07	9.29	8.1E-05	22.1	0.95	7.7E-05
480.0	0.92 4.06	9.08 5.96	41.37	9.59	7.9E-05	21.2	0.97	7.7E-05
480.0	0.92 4.05	9.06 5.94	41.27	9.54	8.0E-05	21.0	0.98	7.8E-05

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Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

Project: **MWH**
No: **00303-014**
Location: **FMC RDRA Data Gap Investigation**
Date: **12/2/2013**
By: **JDF**

Boring No.: **SB-7**
Sample:
Depth: **6-8'**
Sample Description: **light brown silt**
Sample Type: **Undisturbed**

	Initial (o)	Final (f)
Sample Height, H (in)	2.770	2.767
Sample Diameter, D (in)	2.884	2.88
Sample Length, L (cm)	7.036	7.027
Sample Area, A (cm^2)	42.145	41.907
Sample Volume, V (cm^3)	296.52	294.49
Wt. Rings + Wet Soil (g)	628.36	571.21
Wt. Rings (g)	152.04	0
Wet Unit Wt., γ_m (pcf)	100.3	121.1
Wet Soil + Tare (g)	296.8	689.62
Dry Soil + Tare (g)	287.4	568.94
Tare (g)	128.47	122.22
Weight of solids, Ws (g)	449.72	449.72
Water Content, w (%)	5.91	27.01
Dry Unit Wt, γ_d (pcf)	94.7	95.3
Void ratio, e, for assumed Gs	0.75	0.72
Saturation (%), for assumed Gs	21.0	100 ^a
Average K ^b (cm/sec)	6.2E-05	
^a Saturation set to 100% for phase calculations		
^b K corrected to 20°C		

G _s	2.65	Assumed
Cell No.	1	
Station No.	1	
Permeant liquid used	De-aired tap water	
Total backpressure (psi)	49.5	
Effective horiz. consolidation stress (psi)	5	
Effective vert. consolidation stress (psi)	5	
	Initial (o)	Final (f)
B value	0.54	0.96
External Burette (cm ³)	9.90	20.10
Cell Pressure (psi)	0.0	54.5
Backpressure bottom (psi)	49.5	
Backpressure top (psi)	49.5	
System volume coefficient (cm ³ /psi)	0.150	
System volume change (cm ³)	8.16	
Net sample volume change (cm ³)	-2.04	
Bottom burette ground length, l _b (cm)	82.00	
Top burette ground length, l _t (cm)	82.1	
Burette area, a (cm ²)	0.197	
Conversion, reading to cm head (cm/rd)	5.076	

Start Date and Time: 11/27/13 12:26								
Elapsed time (sec)	Bottom Burette (cm ³)	Top Burette (cm ³)	h ₁ (cm)	h ₂ (cm)	K (cm/sec)	Temp (°C)	Visc. Ratic R _f	K ^b (cm/sec)
180.0	0.00 2.56	10.00 7.42	50.66	24.57	6.6E-05	23.6	0.92	6.1E-05
180.0	0.00 2.58	10.00 7.42	50.66	24.47	6.7E-05	23.6	0.92	6.1E-05
180.0	0.00 2.64	10.00 7.35	50.66	23.81	6.9E-05	23.6	0.92	6.4E-05
180.0	0.00 2.64	10.00 7.35	50.66	23.81	6.9E-05	23.6	0.92	6.4E-05

Entered by: _____
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Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

Project: **MWH**
No: **00303-014**
Location: **FMC RDRA Data Gap Investigation**
Date: **12/16/2013**
By: **JDF**

Boring No.: **SB7**
Sample:
Depth: **12-14'**
Sample Description: **Light brown silt**
Sample Type: **Undisturbed**

	Initial (o)	Final (f)
Sample Height, H (in)	4.443	4.429
Sample Diameter, D (in)	2.798	2.76
Sample Length, L (cm)	11.285	11.249
Sample Area, A (cm^2)	39.669	38.653
Sample Volume, V (cm^3)	447.67	434.79
Wt. Rings + Wet Soil (g)	800.26	811.17
Wt. Rings (g)	168.6	0
Wet Unit Wt., γ_m (pcf)	88.1	116.5
Wet Soil + Tare (g)	405.17	1098.2
Dry Soil + Tare (g)	389.85	890.05
Tare (g)	128.62	311.06
Weight of solids, Ws (g)	596.67	596.67
Water Content, w (%)	5.86	35.95
Dry Unit Wt, γ_d (pcf)	83.2	85.7
Void ratio, e, for assumed Gs	0.99	0.95
Saturation (%), for assumed Gs	15.7	100 ^a
Average K^b (cm/sec)	3.1E-04	
^a Saturation set to 100% for phase calculations		
^b K corrected to 20°C		

G _s	2.65	Assumed
Cell No.	H1	
Station No.	1	
Permeant liquid used	De-aired tap water	
Total backpressure (psi)	35	
Effective horiz. consolidation stress (psi)	5	
Effective vert. consolidation stress (psi)	5	
	Initial (o)	Final (f)
B value	0.56	0.98
External Burette (cm ³)	8.80	29.90
Cell Pressure (psi)	0.0	40.0
Backpressure bottom (psi)	35.0	
Backpressure top (psi)	35.0	
System volume coefficient (cm ³ /psi)	0.205	
System volume change (cm ³)	8.22	
Net sample volume change (cm ³)	-12.88	
Bottom burette ground length, l _b (cm)	82.00	
Top burette ground length, l _t (cm)	82.1	
Burette area, a (cm ²)	0.197	
Conversion, reading to cm head (cm/rd)	5.076	

Start Date and Time: 12/13/13 7:24								
Elapsed time (sec)	Bottom Burette (cm ³)	Top Burette (cm ³)	h ₁ (cm)	h ₂ (cm)	K (cm/sec)	Temp (°C)	Visc. Ratic R _f	K ^b (cm/sec)
180.0	0.00 4.32	10.00 5.64	50.66	6.60	3.2E-04	21.8	0.96	3.1E-04
180.0	0.00 4.32	10.00 5.66	50.66	6.70	3.2E-04	21.7	0.96	3.1E-04
180.0	0.00 4.34	10.00 5.66	50.66	6.60	3.2E-04	22.6	0.94	3.0E-04
180.0	0.00 4.36	10.00 5.64	50.66	6.40	3.3E-04	23.1	0.93	3.1E-04

Entered by: _____
Reviewed: _____

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

Project: **MWH**
No: **00303-014**
Location: **FMC RDRA Data Gap Investigation**
Date: **12/17/2013**
By: **NB/JDF**

Boring No.: **SB3**
Sample:
Depth:

Sample Description: **Light brown silt with gravel and sand**
Sample Type: **Remolded**
Compaction Specifications: **105.4** pcf
at **0** (%) w

	Initial (o)	Final (f)
Sample Height, H (in)	2.471	2.436
Sample Diameter, D (in)	2.387	2.32
Sample Length, L (cm)	6.276	6.188
Sample Area, A (cm^2)	28.871	27.253
Sample Volume, V (cm^3)	181.20	168.65
Wt. Rings + Wet Soil (g)	305.97	362.76
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	105.4	134.3
Wet Soil + Tare (g)	1	489.34
Dry Soil + Tare (g)	1	432.79
Tare (g)	0	128.09
Weight of solids, Ws (g)	305.97	305.97
Water Content, w (%)	0.00	18.56
Dry Unit Wt, γ_d (pcf)	105.4	113.3
Void ratio, e, for assumed Gs	0.57	0.49
Saturation (%), for assumed Gs	0.0	100 ^a
Average K ^b (cm/sec)	2.6E-06	

^a Saturation set to 100% for phase calculations

^b K corrected to 20°C

Gs **2.65** Assumed
Cell No. **3**
Station No. **3**
Permeant liquid used **De-aired tap water**
Total backpressure (psi) **30**
Effective horiz. consolidation stress (psi) **11.3**
Effective vert. consolidation stress (psi) **11.3**

	Initial (o)	Final (f)
B value	0.98	1.00
External Burette (cm ³)	14.50	33.30
Cell Pressure (psi)	0.0	41.3

Backpressure bottom (psi) **30.0**
Backpressure top (psi) **30.0**
System volume coefficient (cm³/psi) **0.151**
System volume change (cm³) **6.25**
Net sample volume change (cm³) **-12.55**
Bottom burette ground length, l_b (cm) **82.10**
Top burette ground length, l_t (cm) **81.9**
Burette area, a (cm²) **0.197**
Conversion, reading to cm head (cm/rd) **5.076**

Start Date and Time: 12/16/13 8:32									
Elapsed time (sec)	Bottom Burette (cm ³)	Top Burette (cm ³)	h_1 (cm)	h_2 (cm)	K (cm/sec)	Temp (°C)	Visc. Ratic R_f	K ^b (cm/sec)	
1620.0	0.00 0.94	10.00 9.02	50.96	41.22	2.9E-06	22.8	0.93	2.7E-06	
5160.0	0.94 2.84	9.02 7.12	41.22	21.93	2.7E-06	21.9	0.95	2.6E-06	
3600.0	2.84 3.62	7.12 6.36	21.93	14.11	2.7E-06	22.3	0.95	2.6E-06	
4560.0	3.62 4.20	6.36 5.78	14.11	8.22	2.6E-06	22.4	0.94	2.5E-06	
1680.0	4.20 4.34	5.78 5.64	8.22	6.80	2.5E-06	22.5	0.94	2.4E-06	
960.0	0.00 0.48	10.00 9.42	50.96	45.58	2.6E-06	22.5	0.94	2.4E-06	
5940.0	0.48 2.86	9.42 7.12	45.58	21.82	2.8E-06	22.7	0.94	2.6E-06	

Entered by: _____
Reviewed: _____

Determination of the Soil Water Characteristic Curve for Desorption



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Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **1/15/2014**

By: **NB/MP**

Specific gravity, Gs: **2.650** Assumed

Boring No.: **WUA-TP001-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Sample type: **Laboratory compacted**

Dry unit weight **90.9** pcf

at **8.5** (%) w

Compaction specifications: **85% of**
ASTM D698B

Test No.		1	2	3	4	5	6	7*	8*
Tension (psi)		0.5	1.0	2.0	6.0	18.0	72.0	1235.72	11655.23
Sample A	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035	0.1897	0.1872
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416	1.4720	1.4720
		Sample Volume (ft ³)	0.001	0.001	0.001	0.001	0.001	0.0002	0.0002
		Wt. rings/cup + wet soil (g)	102.97	102.97	102.97	102.97	102.97	32.838	32.448
		Wt. rings/cup (g)	43.33	43.33	43.33	43.33	43.33	24.598	24.578
		Moist soil, Ws (g)	59.64	59.64	59.64	59.64	59.64	8.240	7.870
		Dry soil (g)	55.07	55.07	55.07	55.07	55.07	7.683	7.587
		Moist unit wt., γ_m (pcf)	98.43	98.43	98.43	98.43	98.43	97.24	94.11
		Wet soil + tare (g)	251.73	251.73	251.73	251.73	251.73	32.838	32.448
		Dry soil + tare (g)	242.16	242.16	242.16	242.16	242.16	32.281	32.165
		Tare (g)	126.81	126.81	126.81	126.81	126.81	24.598	24.578
		Moisture Content, w (%)	8.3	8.3	8.3	8.3	8.3	7.25	3.73
		Dry Unit Wt., γ_d (pcf)	90.89	90.89	90.89	90.89	90.89	90.66	90.73
	Final Condition	Wet soil + ring/cup (g)	116.74	115.88	114.20	109.96	107.35	32.831	32.445
		Dry soil + ring/cup (g)	98.40	98.40	98.40	98.40	98.40	32.281	32.165
		Ring/cup (g)	43.33	43.33	43.33	43.33	43.33	24.598	24.578
		Dry soil (g)	55.07	55.07	55.07	55.07	55.07	7.683	7.587
		Moisture Content, w (%)	33.30	31.74	28.69	20.99	16.25	7.16	3.69
		Volumetric Water Content, θ	0.485	0.462	0.418	0.306	0.237	0.104	0.054
Sample B	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035		
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416		
		Sample Volume (ft ³)	0.001	0.001	0.001	0.001	0.001		
		Wt. rings/cup + wet soil (g)	102.40	102.40	102.40	102.40	102.40		
		Wt. rings/cup (g)	42.60	42.60	42.60	42.60	42.60		
		Moist unit wt., γ_m (pcf)	98.70	98.70	98.70	98.70	98.70		
		Wet soil + tare (g)	251.73	251.73	251.73	251.73	251.73		
		Dry soil + tare (g)	242.16	242.16	242.16	242.16	242.16		
		Tare (g)	126.81	126.81	126.81	126.81	126.81		
		Moisture Content, w (%)	8.3	8.3	8.3	8.3	8.3		
		Dry Unit Wt., γ_d (pcf)	91.13	91.13	91.13	91.13	91.13		
	Final Condition	Wet soil + ring/cup (g)	116.01	114.81	113.80	109.78	107.12	105.19	
		Dry soil + ring/cup (g)	97.82	97.82	97.82	97.82	97.82		
		Ring/cup (g)	42.60	42.60	42.60	42.60	42.60		
		Dry soil (g)	55.22	55.22	55.22	55.22	55.22		
		Moisture Content, w (%)	32.94	30.77	28.94	21.66	16.84	13.35	
		Volumetric Water Content, θ	0.481	0.449	0.423	0.316	0.246	0.195	
		Average Volumetric Moisture:	0.483	0.456	0.420	0.311	0.241	0.190	0.104
									0.054

Comments:

*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by: _____

Reviewed: _____

Determination of the Soil Water Characteristic Curve for Desorption



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Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

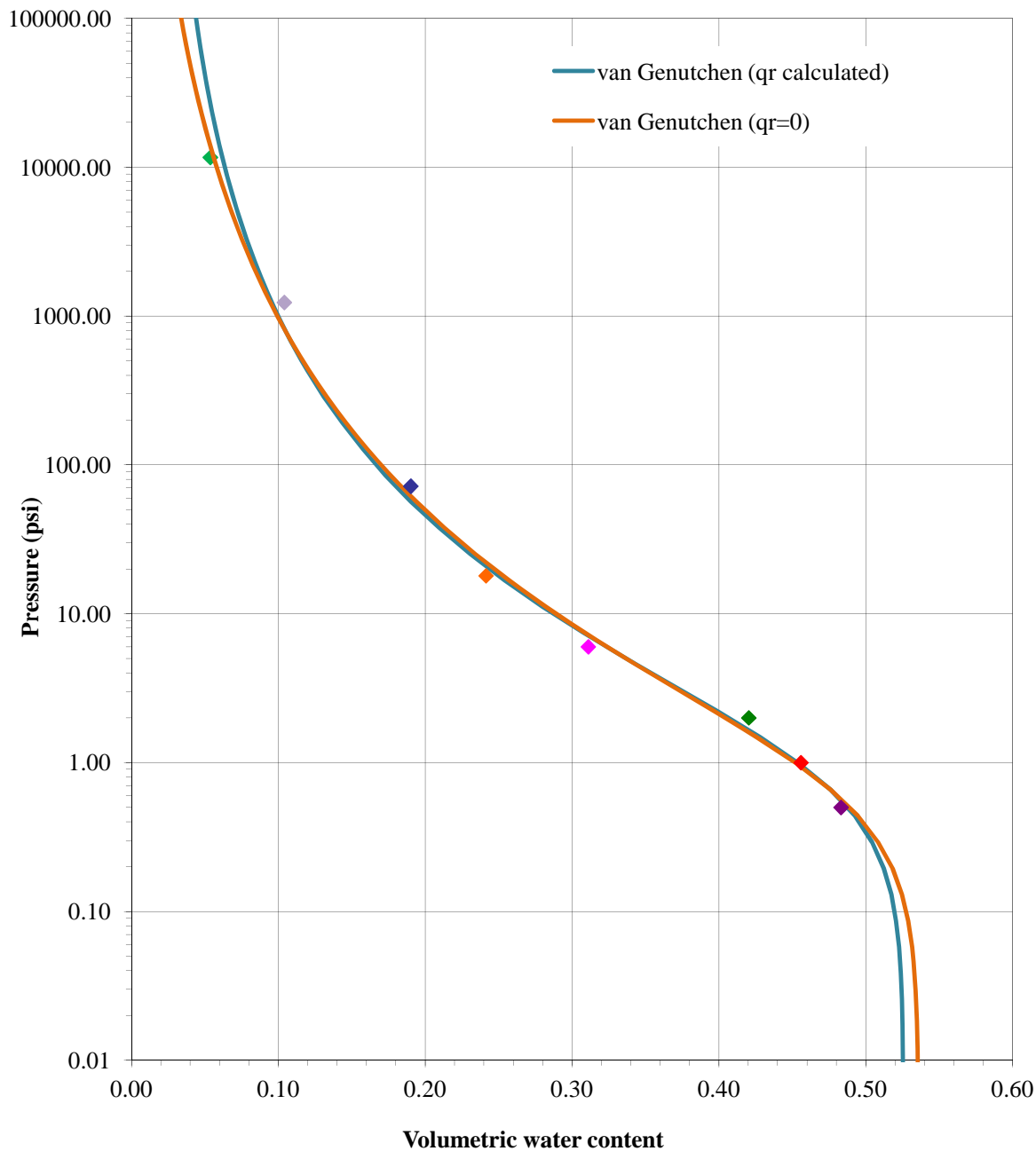
Date: **1/15/2014**

Boring No.: **WUA-TP001-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**



van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

θ_r calculated		Setting $\theta_r = 0$	
θ_s	0.5257	θ_s	0.5358
θ_r	0.0207	θ_r	0
α	1.0624	α	1.3558
n	1.2659	n	1.2337
m	0.2100	m	0.1894
R^2	0.9963	R^2	0.9960

Determination of the Soil Water Characteristic Curve for Desorption



© IGES 2014

Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **1/15/2014**

By: **NB/MP**

Specific gravity, Gs: **2.650** Assumed

Boring No.: **WUA-TP004-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Sample type: **Laboratory compacted**

Dry unit weight **90.4** pcf
at **9** (%) w

Compaction specifications: **85% of**
ASTM D698B

		Test No.	1	2	3	4	5	6	7*	8*
		Tension (psi)	0.5	1.0	2.0	6.0	18.0	72.0	929.69	11344.85
Sample A	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035	0.5035	0.1897	0.1883
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416	2.416	1.4717	1.4718
		Sample Volume (ft³)	0.001	0.001	0.001	0.001	0.001	0.001	0.0002	0.0002
		Wt. rings/cup + wet soil (g)	102.56	102.56	102.56	102.56	102.56	102.56	32.694	32.139
		Wt. rings/cup (g)	42.68	42.68	42.68	42.68	42.68	42.68	24.766	24.371
		Moist soil, Ws (g)	59.88	59.88	59.88	59.88	59.88	59.88	7.928	7.768
		Dry soil (g)	54.84	54.84	54.84	54.84	54.84	54.84	7.594	7.602
		Moist unit wt., γ _m (pcf)	98.83	98.83	98.83	98.83	98.83	98.83	93.60	92.37
		Wet soil + tare (g)	328.04	328.04	328.04	328.04	328.04	328.04	32.694	32.139
		Dry soil + tare (g)	312.20	312.20	312.20	312.20	312.20	312.20	32.360	31.973
		Tare (g)	139.72	139.72	139.72	139.72	139.72	139.72	24.766	24.371
		Moisture Content, w (%)	9.2	9.2	9.2	9.2	9.2	9.2	4.40	2.18
	Dry Unit Wt., γ _d (pcf)	90.51	90.51	90.51	90.51	90.51	90.51	89.65	90.40	
	Final Condition	Wet soil + ring/cup (g)	114.28	113.48	112.54	110.27	103.80	101.73	32.683	32.137
		Dry soil + ring/cup (g)	97.52	97.52	97.52	97.52	97.52	97.52	32.360	31.973
		Ring/cup (g)	42.68	42.68	42.68	42.68	42.68	42.68	24.766	24.371
		Dry soil (g)	54.84	54.84	54.84	54.84	54.84	54.84	7.594	7.602
		Moisture Content, w (%)	30.55	29.09	27.38	23.24	11.44	7.67	4.25	2.16
		Volumetric Water Content, θ	0.443	0.422	0.397	0.337	0.166	0.111	0.061	0.031
Sample B		Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035	0.5035	
	Sample diameter, D (in)		2.416	2.416	2.416	2.416	2.416	2.416		
	Sample Volume (ft³)		0.001	0.001	0.001	0.001	0.001	0.001		
	Wt. rings/cup + wet soil (g)		102.75	102.75	102.75	102.75	102.75	102.75		
	Wt. rings/cup (g)		42.84	42.84	42.84	42.84	42.84	42.84		
	Moist unit wt., γ _m (pcf)		98.88	98.88	98.88	98.88	98.88	98.88		
	Wet soil + tare (g)		328.04	328.04	328.04	328.04	328.04	328.04		
	Dry soil + tare (g)		312.20	312.20	312.20	312.20	312.20	312.20		
	Tare (g)		139.72	139.72	139.72	139.72	139.72	139.72		
	Moisture Content, w (%)		9.2	9.2	9.2	9.2	9.2	9.2		
	Dry Unit Wt., γ _d (pcf)	90.56	90.56	90.56	90.56	90.56	90.56			
	Final Condition	Wet soil + ring/cup (g)	114.69	113.81	112.65	109.02	103.31	101.57		
		Dry soil + ring/cup (g)	97.71	97.71	97.71	97.71	97.71	97.71		
		Ring/cup (g)	42.84	42.84	42.84	42.84	42.84	42.84		
		Dry soil (g)	54.87	54.87	54.87	54.87	54.87	54.87		
Moisture Content, w (%)		30.94	29.34	27.23	20.61	10.20	7.03			
Volumetric Water Content, θ		0.449	0.426	0.395	0.299	0.148	0.102			
Average Volumetric Moisture:			0.446	0.424	0.396	0.318	0.157	0.107	0.061	0.031

Comments:

*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by: _____

Reviewed: _____

Determination of the Soil Water Characteristic Curve for Desorption



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Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

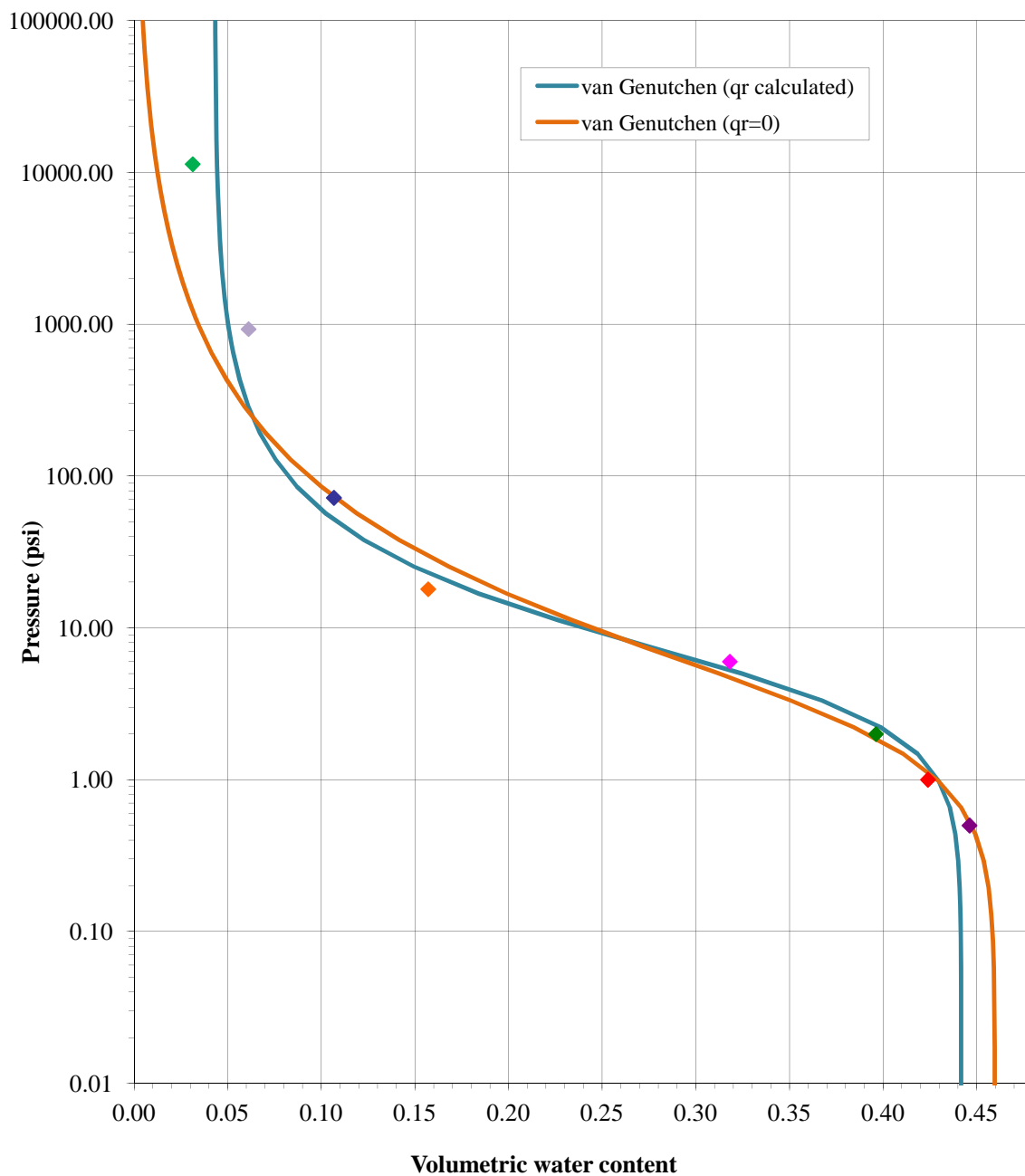
Date: **1/15/2014**

Boring No.: **WUA-TP004-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**



van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

θ_r calculated

θ_s	0.4417	θ_s	0.4597
θ_r	0.0431	θ_r	0
α	0.2293	α	0.3874
n	1.7409	n	1.4358
m	0.4256	m	0.3035
R^2	0.9963	R^2	0.9872

Determination of the Soil Water Characteristic Curve for Desorption



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Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **1/15/2014**

By: **NB/MP**

Specific gravity, Gs: **2.650** Assumed

Boring No.: **WUA-TP006-01**

Sample:

Depth: **1-10'**

Description: **Brown silty clay**

Sample type: **Laboratory compacted**

Dry unit weight **88.7** pcf

at **8.5** (%) w

Compaction specifications: **85% of**
ASTM D698B

		Test No.	1	2	3	4	5	6	7*	8*
		Tension (psi)	0.5	1.0	2.0	6.0	18.0	72.0	462.67	6381.66
Sample A	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035	0.5035	0.1883	0.1875
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416	2.416	1.4715	1.4725
		Sample Volume (ft³)	0.001	0.001	0.001	0.001	0.001	0.001	0.0002	0.0002
		Wt. rings/cup + wet soil (g)	101.62	101.62	101.62	101.62	101.62	101.62	32.585	32.480
		Wt. rings/cup (g)	43.06	43.06	43.06	43.06	43.06	43.06	24.595	24.774
		Moist soil, Ws (g)	58.56	58.56	58.56	58.56	58.56	58.56	7.990	7.706
		Dry soil (g)	53.83	53.83	53.83	53.83	53.83	53.83	7.446	7.429
		Moist unit wt., γ_m (pcf)	96.65	96.65	96.65	96.65	96.65	96.65	95.05	91.94
		Wet soil + tare (g)	304.54	304.54	304.54	304.54	304.54	304.54	32.585	32.480
		Dry soil + tare (g)	289.91	289.91	289.91	289.91	289.91	289.91	32.041	32.203
		Tare (g)	123.34	123.34	123.34	123.34	123.34	123.34	24.595	24.774
		Moisture Content, w (%)	8.8	8.8	8.8	8.8	8.8	8.8	7.31	3.73
		Dry Unit Wt., γ_d (pcf)	88.85	88.85	88.85	88.85	88.85	88.85	88.58	88.64
	Final Condition	Wet soil + ring/cup (g)	114.15	113.24	112.02	109.13	105.67	103.28	32.578	32.478
		Dry soil + ring/cup (g)	96.89	96.89	96.89	96.89	96.89	96.89	32.041	32.203
		Ring/cup (g)	43.06	43.06	43.06	43.06	43.06	43.06	24.595	24.774
		Dry soil (g)	53.83	53.83	53.83	53.83	53.83	53.83	7.446	7.429
		Moisture Content, w (%)	32.06	30.37	28.10	22.73	16.31	11.87	7.21	3.70
		Volumetric Water Content, θ	0.456	0.432	0.400	0.324	0.232	0.169	0.102	0.053
Sample B	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035	0.5035		
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416	2.416		
		Sample Volume (ft³)	0.001	0.001	0.001	0.001	0.001	0.001		
		Wt. rings/cup + wet soil (g)	101.04	101.04	101.04	101.04	101.04	101.04		
		Wt. rings/cup (g)	42.48	42.48	42.48	42.48	42.48	42.48		
		Moist unit wt., γ_m (pcf)	96.65	96.65	96.65	96.65	96.65	96.65		
		Wet soil + tare (g)	304.54	304.54	304.54	304.54	304.54	304.54		
		Dry soil + tare (g)	289.91	289.91	289.91	289.91	289.91	289.91		
		Tare (g)	123.34	123.34	123.34	123.34	123.34	123.34		
		Moisture Content, w (%)	8.8	8.8	8.8	8.8	8.8	8.8		
	Final Condition	Dry Unit Wt., γ_d (pcf)	88.85	88.85	88.85	88.85	88.85	88.85		
		Wet soil + ring/cup (g)	113.86	112.86	111.67	108.66	104.88	102.81		
		Dry soil + ring/cup (g)	96.31	96.31	96.31	96.31	96.31	96.31		
		Ring/cup (g)	42.48	42.48	42.48	42.48	42.48	42.48		
		Dry soil (g)	53.83	53.83	53.83	53.83	53.83	53.83		
		Moisture Content, w (%)	32.60	30.74	28.53	22.94	15.92	12.07		
		Volumetric Water Content, θ	0.464	0.438	0.406	0.327	0.227	0.172		
Average Volumetric Moisture:			0.460	0.435	0.403	0.325	0.229	0.170	0.102	0.053

Comments:

*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by: _____

Reviewed: _____

Determination of the Soil Water Characteristic Curve for Desorption



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Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: MWH

No: 00303-014

Location: FMC RDRA Data Gap Investigation

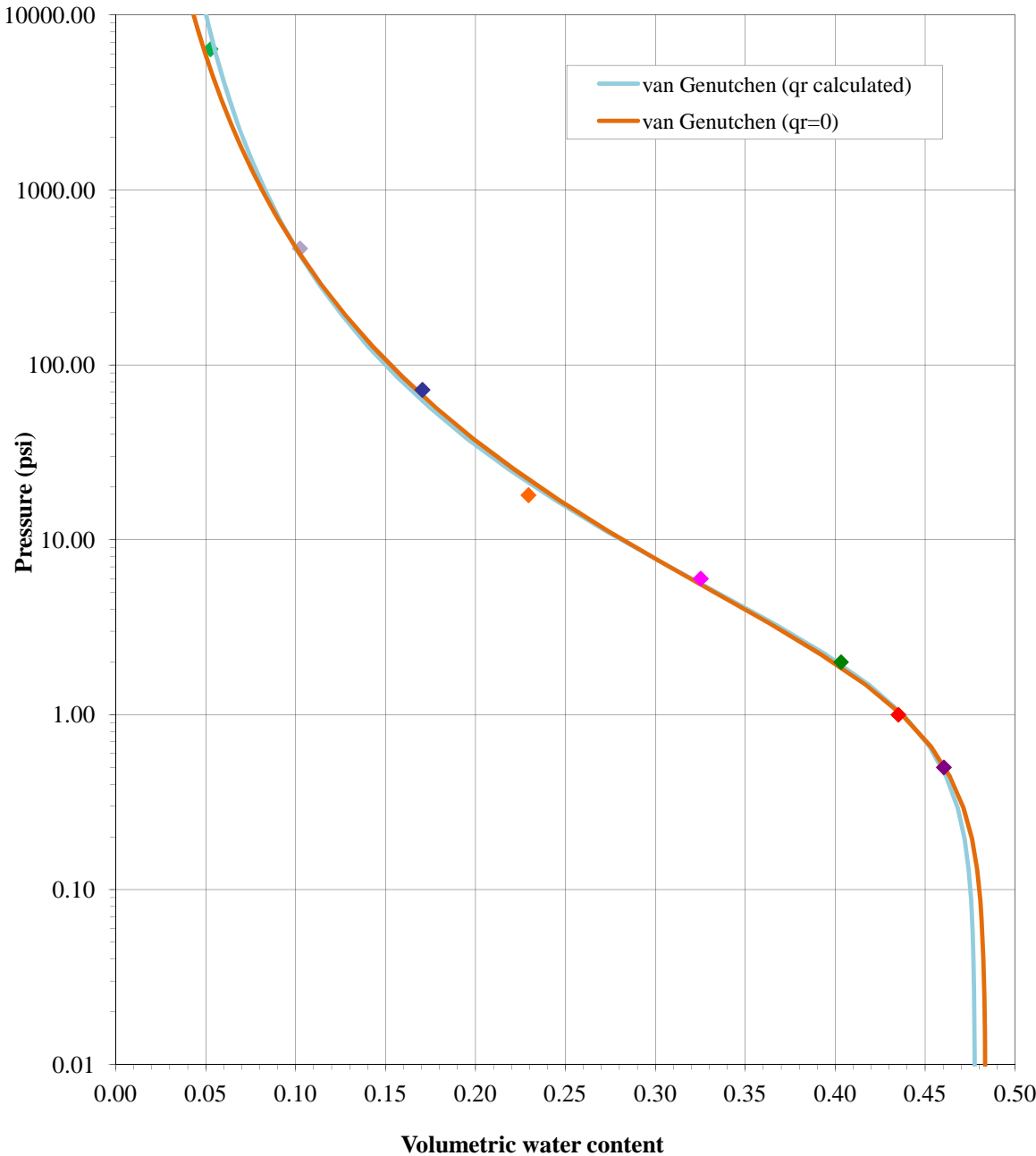
Date: 1/15/2014

Boring No.: WUA-TP006-01

Sample:

Depth: 1-10'

Description: Brown silty clay



van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

θ_r calculated

θ_s	0.4776	θ_s	0.4834
θ_r	0.0191	θ_r	0
α	0.5592	α	0.6705
n	1.3116	n	1.2739
m	0.2376	m	0.2150
R^2	0.9988	R^2	0.9985

Determination of the Soil Water Characteristic Curve for Desorption



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Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **1/15/2014**

By: **NB/MP**

Specific gravity, Gs: **2.650** Assumed

Boring No.: **WUA-TP007-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Sample type: **Laboratory compacted**

Dry unit weight **88.6** pcf

at **8.5** (%) w

Compaction specifications: **85% of**
ASTM D698B

Test No.		1	2	3	4	5	6	7*	8*
Tension (psi)		0.5	1.0	2.0	6.0	18.0	72.0	433.66	6612.27
Sample A	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035	0.1865	0.1863
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416	1.4717	1.4710
		Sample Volume (ft ³)	0.001	0.001	0.001	0.001	0.001	0.0002	0.0002
		Wt. rings/cup + wet soil (g)	100.70	100.70	100.70	100.70	100.70	32.462	32.209
		Wt. rings/cup (g)	42.58	42.58	42.58	42.58	42.58	24.556	24.586
		Moist soil, Ws (g)	58.12	58.12	58.12	58.12	58.12	7.906	7.623
		Dry soil (g)	53.71	53.71	53.71	53.71	53.71	7.368	7.343
		Moist unit wt., γ_m (pcf)	95.92	95.92	95.92	95.92	95.92	94.94	91.72
		Wet soil + tare (g)	304.93	304.93	304.93	304.93	304.93	32.462	32.209
		Dry soil + tare (g)	291.11	291.11	291.11	291.11	291.11	31.924	31.929
		Tare (g)	123.00	123.00	123.00	123.00	123.00	24.556	24.586
		Moisture Content, w (%)	8.2	8.2	8.2	8.2	8.2	7.30	3.81
		Dry Unit Wt., γ_d (pcf)	88.64	88.64	88.64	88.64	88.64	88.48	88.35
	Final Condition	Wet soil + ring/cup (g)	113.27	111.89	110.72	106.51	103.65	32.452	32.206
		Dry soil + ring/cup (g)	96.29	96.29	96.29	96.29	96.29	31.924	31.929
		Ring/cup (g)	42.58	42.58	42.58	42.58	42.58	24.556	24.586
		Dry soil (g)	53.71	53.71	53.71	53.71	53.71	7.368	7.343
		Moisture Content, w (%)	31.63	29.06	26.88	19.04	13.71	7.17	3.77
		Volumetric Water Content, θ	0.449	0.413	0.382	0.270	0.195	0.102	0.053
Sample B	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035		
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416		
		Sample Volume (ft ³)	0.001	0.001	0.001	0.001	0.001		
		Wt. rings/cup + wet soil (g)	101.26	101.26	101.26	101.26	101.26		
		Wt. rings/cup (g)	43.11	43.11	43.11	43.11	43.11		
		Moist unit wt., γ_m (pcf)	95.97	95.97	95.97	95.97	95.97		
		Wet soil + tare (g)	304.93	304.93	304.93	304.93	304.93		
		Dry soil + tare (g)	291.11	291.11	291.11	291.11	291.11		
		Tare (g)	123.00	123.00	123.00	123.00	123.00		
		Moisture Content, w (%)	8.2	8.2	8.2	8.2	8.2		
		Dry Unit Wt., γ_d (pcf)	88.68	88.68	88.68	88.68	88.68		
	Final Condition	Wet soil + ring/cup (g)	113.98	113.22	111.66	107.07	104.39	103.04	
		Dry soil + ring/cup (g)	96.84	96.84	96.84	96.84	96.84		
		Ring/cup (g)	43.11	43.11	43.11	43.11	43.11		
		Dry soil (g)	53.73	53.73	53.73	53.73	53.73		
		Moisture Content, w (%)	31.89	30.48	27.58	19.03	14.05	11.53	
		Volumetric Water Content, θ	0.453	0.433	0.392	0.271	0.200	0.164	
		Average Volumetric Moisture:	0.451	0.423	0.387	0.270	0.197	0.158	0.102
									0.053

Comments:

*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by: _____

Reviewed: _____

Determination of the Soil Water Characteristic Curve for Desorption



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Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

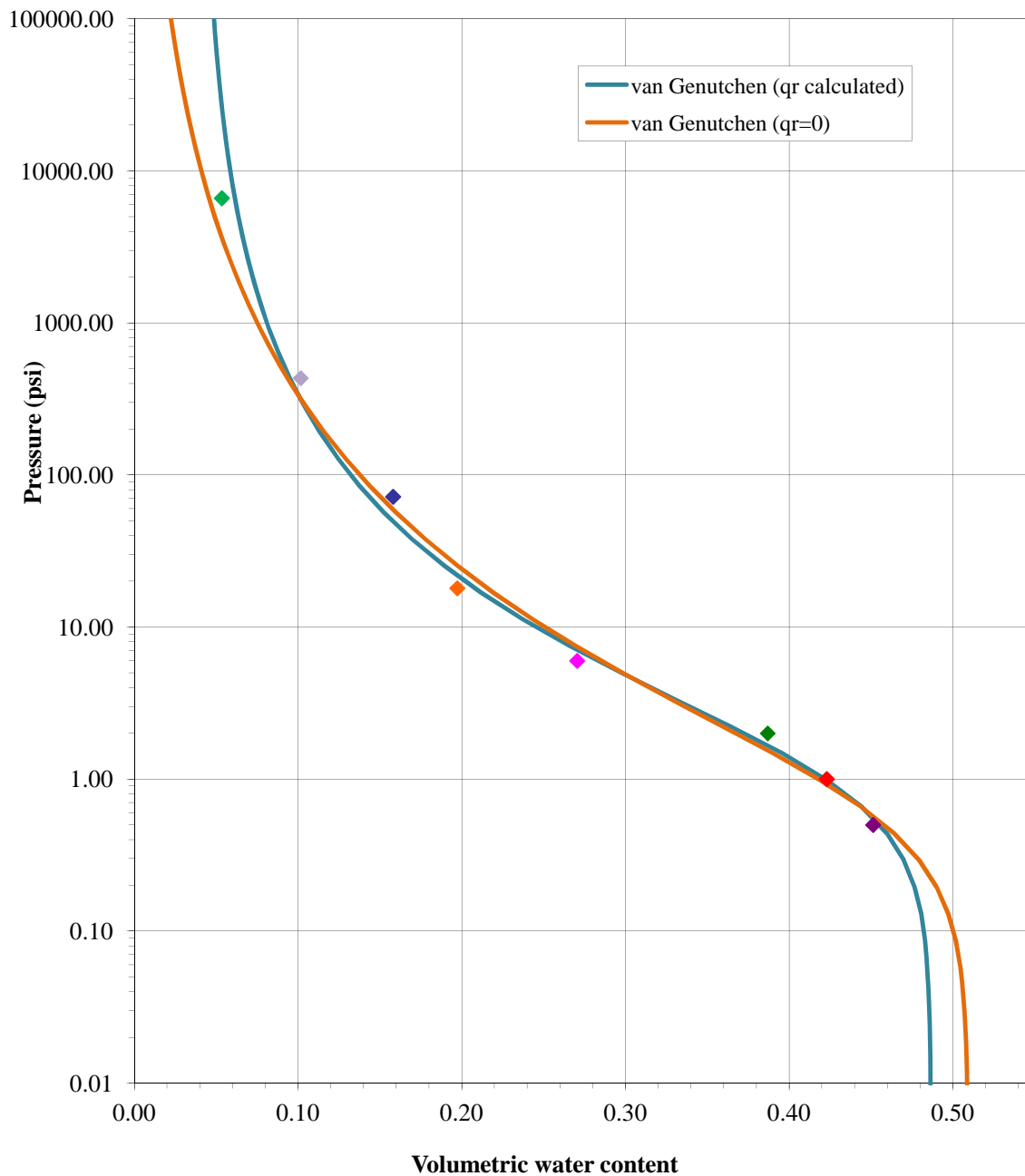
Date: **1/15/2014**

Boring No.: **WUA-TP007-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**



van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

θ_r calculated

θ_s	0.4865	θ_s	0.5091
θ_r	0.0409	θ_r	0
α	0.8571	α	1.4349
n	1.3562	n	1.2632
m	0.2626	m	0.2084
R^2	0.9947	R^2	0.9926

Determination of the Soil Water Characteristic Curve for Desorption



© IGES 2014

Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

Date: **1/15/2014**

By: **NB/MP**

Specific gravity, Gs: **2.650** Assumed

Boring No.: **WUA-TP008-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**

Sample type: **Laboratory compacted**

Dry unit weight **84.7** pcf

at **8.5** (%) w

Compaction specifications: **85% of**
ASTM D698B

		Test No.	1	2	3	4	5	6	7*	8*
		Tension (psi)	0.5	1.0	2.0	6.0	18.0	72.0	577.25	12281.80
Sample A	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035	0.5035	0.1900	0.1892
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416	2.416	1.4713	1.4718
		Sample Volume (ft³)	0.001	0.001	0.001	0.001	0.001	0.001	0.0002	0.0002
		Wt. rings/cup + wet soil (g)	100.65	100.65	100.65	100.65	100.65	100.65	32.165	31.985
		Wt. rings/cup (g)	44.89	44.89	44.89	44.89	44.89	44.89	24.447	24.557
		Moist soil, Ws (g)	55.76	55.76	55.76	55.76	55.76	55.76	7.718	7.428
		Dry soil (g)	51.35	51.35	51.35	51.35	51.35	51.35	7.147	7.152
		Moist unit wt., γ _m (pcf)	92.03	92.03	92.03	92.03	92.03	92.03	91.02	87.91
		Wet soil + tare (g)	379.66	379.66	379.66	379.66	379.66	379.66	32.165	31.985
		Dry soil + tare (g)	360.76	360.76	360.76	360.76	360.76	360.76	31.594	31.709
		Tare (g)	140.47	140.47	140.47	140.47	140.47	140.47	24.447	24.557
		Moisture Content, w (%)	8.6	8.6	8.6	8.6	8.6	8.6	7.99	3.86
		Dry Unit Wt., γ _d (pcf)	84.76	84.76	84.76	84.76	84.76	84.76	84.28	84.64
	Final Condition	Wet soil + ring/cup (g)	114.84	114.05	112.48	107.60	103.87	102.26	32.152	31.979
		Dry soil + ring/cup (g)	96.24	96.24	96.24	96.24	96.24	96.24	31.594	31.709
		Ring/cup (g)	44.89	44.89	44.89	44.89	44.89	44.89	24.447	24.557
		Dry soil (g)	51.35	51.35	51.35	51.35	51.35	51.35	7.147	7.152
		Moisture Content, w (%)	36.21	34.67	31.62	22.11	14.85	11.71	7.81	3.78
		Volumetric Water Content, θ	0.492	0.471	0.429	0.300	0.202	0.159	0.105	0.051
Sample B	Initial Condition	Sample height, H (in)	0.5035	0.5035	0.5035	0.5035	0.5035	0.5035		
		Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416	2.416		
		Sample Volume (ft³)	0.001	0.001	0.001	0.001	0.001	0.001		
		Wt. rings/cup + wet soil (g)	101.75	101.75	101.75	101.75	101.75	101.75		
		Wt. rings/cup (g)	45.98	45.98	45.98	45.98	45.98	45.98		
		Moist unit wt., γ _m (pcf)	92.04	92.04	92.04	92.04	92.04	92.04		
		Wet soil + tare (g)	379.66	379.66	379.66	379.66	379.66	379.66		
		Dry soil + tare (g)	360.76	360.76	360.76	360.76	360.76	360.76		
		Tare (g)	140.47	140.47	140.47	140.47	140.47	140.47		
		Moisture Content, w (%)	8.6	8.6	8.6	8.6	8.6	8.6		
	Final Condition	Dry Unit Wt., γ _d (pcf)	84.77	84.77	84.77	84.77	84.77	84.77		
		Wet soil + ring/cup (g)	115.88	114.65	113.25	108.03	104.97	103.23		
		Dry soil + ring/cup (g)	97.34	97.34	97.34	97.34	97.34	97.34		
		Ring/cup (g)	45.98	45.98	45.98	45.98	45.98	45.98		
		Dry soil (g)	51.36	51.36	51.36	51.36	51.36	51.36		
		Moisture Content, w (%)	36.09	33.69	30.97	20.81	14.85	11.46		
		Volumetric Water Content, θ	0.490	0.458	0.421	0.283	0.202	0.156		
Average Volumetric Moisture:			0.491	0.464	0.425	0.292	0.202	0.157	0.105	0.051

Comments:

*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

Entered by: _____

Reviewed: _____

Determination of the Soil Water Characteristic Curve for Desorption



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Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: **MWH**

No: **00303-014**

Location: **FMC RDRA Data Gap Investigation**

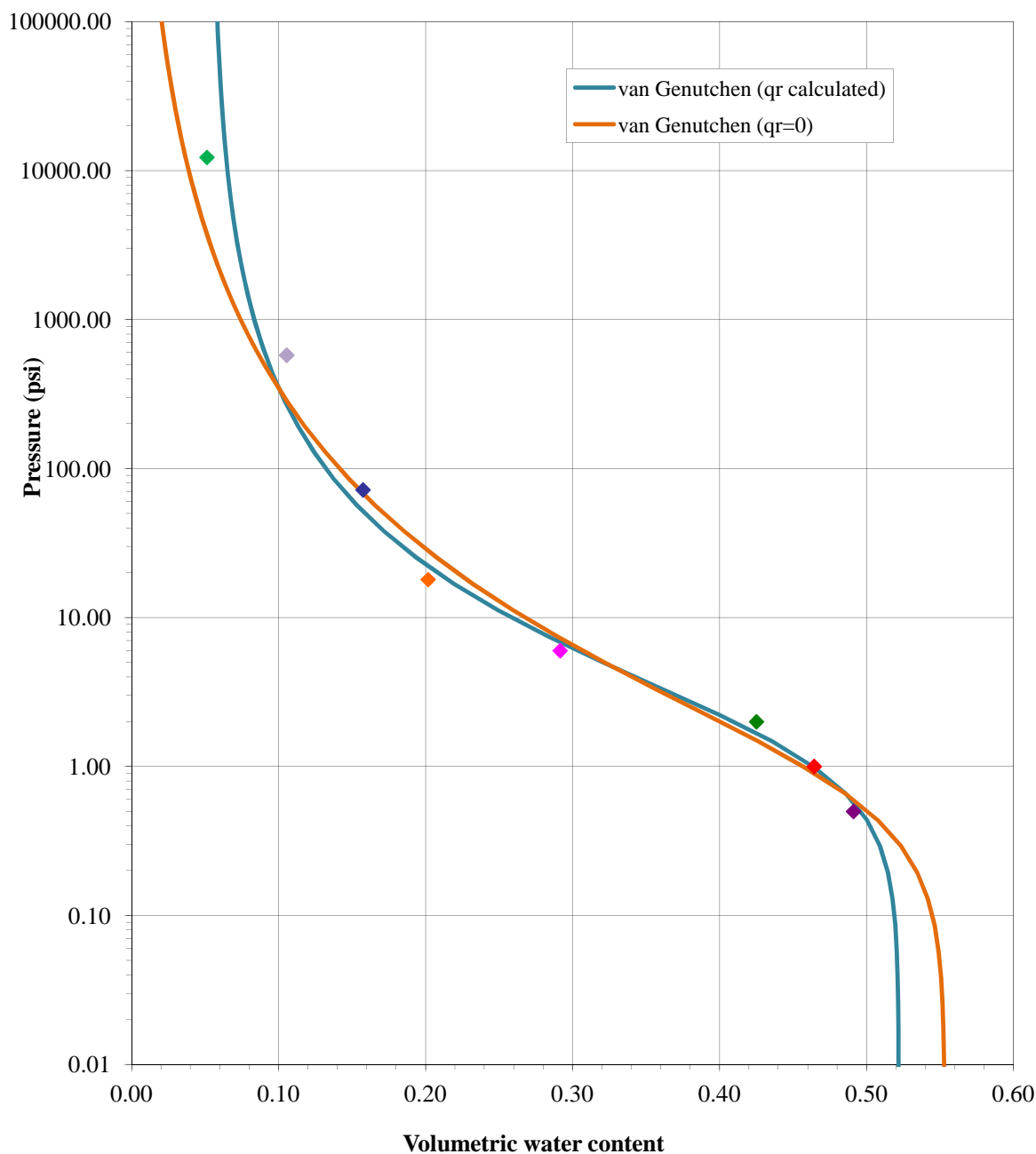
Date: **1/15/2014**

Boring No.: **WUA-TP008-01**

Sample:

Depth: **1-10'**

Description: **Brown silt**



van Genuchten fitting parameters (using SWRC fit, Seki, K. (2007)):

θ_r calculated

θ_s	0.5219	θ_s	0.5533
θ_r	0.0543	θ_r	0
α	0.6665	α	1.2965
n	1.4267	n	1.2802
m	0.2991	m	0.2189
R^2	0.9946	R^2	0.9898

APPENDIX E

Agronomic Testing Reports

December 11, 2013

Report to:

Chad Tomlinson
MWH Americas Inc.
2890 E. Cottonwood Pkwy.
Suite 300
Salt Lake City, UT 84121

Bill to:

Accounts Payable
MWH Americas Inc.
P.O. Box 6610
Broomfield, CO 80021

Project ID: 10503311.020102 FML

ACZ Project ID: L15653

Chad Tomlinson:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on November 20, 2013. This project has been assigned to ACZ's project number, L15653. Please reference this number in all future inquiries.

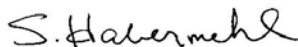
All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L15653. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after January 10, 2014. If the samples are determined to be hazardous, additional charges apply for disposal (typically \$11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.



Scott Habermehl has reviewed
and approved this report.



MWH Americas Inc.

December 11, 2013

Project ID: 10503311.020102 FML

ACZ Project ID: L15653

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 3 soil samples from MWH Americas Inc. on November 20, 2013. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L15653. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Samples were received outside the EPA recommended temperature of 0-6 degrees C.

Holding Times

All analyses were performed within EPA recommended holding times.

Sample Analysis

These samples were analyzed for inorganic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports. The extended qualifier reports may contain footnotes qualifying specific elements due to QC failures. In addition the following has been noted with this specific project:

1. (B1) Target analyte detected in prep blank at or above the method reporting limit. This is due to procedural contamination at the prep level. Client may opt to blank subtract at their discretion.

MWH Americas Inc.

Project ID: 10503311.020102 FML
 Sample ID: WUA-CP01

ACZ Sample ID: **L15653-01**
 Date Sampled: 11/05/13 10:00
 Date Received: 11/20/13
 Sample Matrix: Soil

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cation Exchange Capacity (CEC)	USDA No. 60 (19)	1	8.50		*	meq/100g	0.03	0.2	12/05/13 11:36	aeb
Phosphorus, total (3050)	M6010B ICP	101	790		*	mg/Kg	10	50	12/02/13 21:44	aeb
Potassium, total (3050)	M6010B ICP	101	2410			mg/Kg	30	200	12/02/13 21:44	aeb

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1	0.2	B	*	%	0.1	0.5	12/05/13 14:52	cra
Conductivity @25C	SM2510B									
Conductivity		1	0.442		*	mmhos/cm	0.001	0.01	11/27/13 0:00	spl
Max Particle Size		1	2000		*	um			11/27/13 0:00	spl
Organic Matter	USDA No.60 - Method 24	1	0.8	B	*	%	0.3	1	11/25/13 22:08	cra
pH, Saturated Paste	EPA 600/2-78-054, section 3.2.2									
Max Particle Size		1	2000		*	um			11/27/13 0:00	spl
pH		1	8.6		*	units	0.1	0.1	11/27/13 0:00	spl
Solids, Percent	CLPSOW390, PART F, D-98	1	94.1		*	%	0.1	0.5	11/22/13 13:54	spl

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972				*				11/24/13 11:00	mss2
Cation Exchange Capacity Extraction	USDA No. 60 (19)				*				12/04/13 18:22	cdb
Digestion - Hot Plate	M3050B ICP								11/26/13 13:20	mss2
Potassium Chloride Extraction	ASA No. 9 33-3.2.2				*				12/04/13 15:00	spl
Saturated Paste Extraction	USDA No. 60 (2)				*				11/26/13 14:20	spl
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2				*				11/25/13 11:00	cra
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2				*				11/25/13 11:00	cra

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate	10	10.6		*	mg/Kg	0.5	5	12/10/13 17:16	bsu

Arizona license number: AZ0102

MWH Americas Inc.

Project ID: 10503311.020102 FML
 Sample ID: WUA-CP02

ACZ Sample ID: **L15653-02**
 Date Sampled: 11/05/13 10:00
 Date Received: 11/20/13
 Sample Matrix: Soil

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cation Exchange Capacity (CEC)	USDA No. 60 (19)	1	11.0		*	meq/100g	0.03	0.2	12/05/13 11:45	aeb
Phosphorus, total (3050)	M6010B ICP	102	780		*	mg/Kg	10	50	12/02/13 21:53	aeb
Potassium, total (3050)	M6010B ICP	102	2780			mg/Kg	30	200	12/02/13 21:53	aeb

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1	0.2	B	*	%	0.1	0.5	12/06/13 2:37	cra
Conductivity @25C	SM2510B									
Conductivity		1	0.594		*	mmhos/cm	0.001	0.01	11/27/13 0:00	spl
Max Particle Size		1	2000		*	um			11/27/13 0:00	spl
Organic Matter	USDA No.60 - Method 24	1	0.9	B	*	%	0.3	1	11/26/13 4:17	cra
pH, Saturated Paste	EPA 600/2-78-054, section 3.2.2									
Max Particle Size		1	2000		*	um			11/27/13 0:00	spl
pH		1	8.4		*	units	0.1	0.1	11/27/13 0:00	spl
Solids, Percent	CLPSOW390, PART F, D-98	1	91.9		*	%	0.1	0.5	11/22/13 14:57	spl

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972				*				11/24/13 11:30	mss2
Cation Exchange Capacity Extraction	USDA No. 60 (19)				*				12/04/13 23:15	cdb
Digestion - Hot Plate	M3050B ICP								11/26/13 15:20	mss2
Potassium Chloride Extraction	ASA No. 9 33-3.2.2				*				12/04/13 17:00	spl
Saturated Paste Extraction	USDA No. 60 (2)				*				11/27/13 4:16	spl
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2				*				11/25/13 11:30	cra
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2				*				11/25/13 11:30	cra

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate	10	11.1		*	mg/Kg	0.5	5	12/10/13 17:19	bsu

Arizona license number: AZ0102

MWH Americas Inc.

Project ID: 10503311.020102 FML

Sample ID: WUA-CP03

ACZ Sample ID: **L15653-03**

Date Sampled: 11/05/13 10:00

Date Received: 11/20/13

Sample Matrix: Soil

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cation Exchange Capacity (CEC)	USDA No. 60 (19)	1	10.0		*	meq/100g	0.03	0.2	12/05/13 11:52	aeb
Phosphorus, total (3050)	M6010B ICP	101	790		*	mg/Kg	10	50	12/02/13 21:56	aeb
Potassium, total (3050)	M6010B ICP	101	2620			mg/Kg	30	200	12/02/13 21:56	aeb

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	1	0.2	B	*	%	0.1	0.5	12/06/13 8:30	cra
Conductivity @25C	SM2510B									
Conductivity		1	0.456		*	mmhos/cm	0.001	0.01	11/27/13 0:00	spl
Max Particle Size		1	2000		*	um			11/27/13 0:00	spl
Organic Matter	USDA No.60 - Method 24	1	0.9	B	*	%	0.3	1	11/26/13 7:21	cra
pH, Saturated Paste	EPA 600/2-78-054, section 3.2.2									
Max Particle Size		1	2000		*	um			11/27/13 0:00	spl
pH		1	8.5		*	units	0.1	0.1	11/27/13 0:00	spl
Solids, Percent	CLPSOW390, PART F, D-98	1	93.0		*	%	0.1	0.5	11/22/13 16:00	spl

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972				*				11/24/13 12:00	mss2
Cation Exchange Capacity Extraction	USDA No. 60 (19)				*				12/05/13 4:07	cdb
Digestion - Hot Plate	M3050B ICP								11/26/13 16:00	mss2
Potassium Chloride Extraction	ASA No. 9 33-3.2.2				*				12/04/13 18:00	spl
Saturated Paste Extraction	USDA No. 60 (2)				*				11/27/13 11:15	spl
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2				*				11/25/13 12:00	cra
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2				*				11/25/13 12:00	cra

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate	10	10.7		*	mg/Kg	0.5	5	12/10/13 17:21	bsu

Arizona license number: AZ0102



Report Header Explanations

<i>Batch</i>	A distinct set of samples analyzed at a specific time
<i>Found</i>	Value of the QC Type of interest
<i>Limit</i>	Upper limit for RPD, in %.
<i>Lower</i>	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
<i>MDL</i>	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
<i>PCN/SCN</i>	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
<i>PQL</i>	Practical Quantitation Limit, typically 5 times the MDL.
<i>QC</i>	True Value of the Control Sample or the amount added to the Spike
<i>Rec</i>	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
<i>RPD</i>	Relative Percent Difference, calculation used for Duplicate QC Types
<i>Upper</i>	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
<i>Sample</i>	Value of the Sample of interest

QC Sample Types

<i>AS</i>	Analytical Spike (Post Digestion)	<i>LCSWD</i>	Laboratory Control Sample - Water Duplicate
<i>ASD</i>	Analytical Spike (Post Digestion) Duplicate	<i>LFB</i>	Laboratory Fortified Blank
<i>CCB</i>	Continuing Calibration Blank	<i>LFM</i>	Laboratory Fortified Matrix
<i>CCV</i>	Continuing Calibration Verification standard	<i>LFMD</i>	Laboratory Fortified Matrix Duplicate
<i>DUP</i>	Sample Duplicate	<i>LRB</i>	Laboratory Reagent Blank
<i>ICB</i>	Initial Calibration Blank	<i>MS</i>	Matrix Spike
<i>ICV</i>	Initial Calibration Verification standard	<i>MSD</i>	Matrix Spike Duplicate
<i>ICSAB</i>	Inter-element Correction Standard - A plus B solutions	<i>PBS</i>	Prep Blank - Soil
<i>LCSS</i>	Laboratory Control Sample - Soil	<i>PBW</i>	Prep Blank - Water
<i>LCSSD</i>	Laboratory Control Sample - Soil Duplicate	<i>PQV</i>	Practical Quantitation Verification standard
<i>LCSW</i>	Laboratory Control Sample - Water	<i>SDL</i>	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

- (1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
- (2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
- (3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
- (4) EPA SW-846. Test Methods for Evaluating Solid Waste.
- (5) Standard Methods for the Examination of Water and Wastewater.

Comments

- (1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
- (2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
- (3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
- (4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
- (5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click:

<http://www.acz.com/public/extquallist.pdf>

MWH Americas Inc.

ACZ Project ID: **L15653**

Carbon, total organic (TOC)

ASA No.9 29-2.2.4 Combustion/IR

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG355912													
WG355912PBS	PBS	12/05/13 9:00				U	%		-0.3	0.3			
L15653-01DUP	DUP	12/05/13 20:45			.2	.2	%				0	20	RA ZQ

Cation Exchange Capacity (CEC)

USDA No. 60 (19)

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG355925													
WG355925ICV	ICV	12/05/13 11:17	II131113-1	100		97.97	mg/L	98	90	110			
WG355925ICB	ICB	12/05/13 11:20				U	meq/100g		-0.9	0.9			
WG355857PBS	PBS	12/05/13 11:33				U	meq/100g		-0.09	0.09			
L15653-01AS	AS	12/05/13 11:39	IIICECSPIKE	10.8763	8.5	17.0846	meq/100g	78.9	75	125			
L15653-01ASD	ASD	12/05/13 11:42	IIICECSPIKE	10.8763	8.5	17.4218	meq/100g	82	75	125	1.95	20	
L15653-03DUP	DUP	12/05/13 11:55			10	10.1496	meq/100g				1.5	20	

Conductivity @25C

SM2510B

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG355542													
L15653-01DUP	DUP	11/27/13 3:24			.442	.443	nmhos/cm				0.2	20	

Nitrogen, ammonia (KCL)

M350.1 - Automated Phenate

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG356166													
WG356166ICV	ICV	12/10/13 12:10	WI131021-1	1.003		1.041	mg/L	103.8	90	110			
WG356166ICB	ICB	12/10/13 12:13				U	mg/L		-0.15	0.15			
WG356206													
WG356206LFB	LFB	12/10/13 17:14	WI121218-3	1		1.093	mg/L	109.3	90	110			
WG355866PBS	PBS	12/10/13 17:15				6.27	mg/Kg		-1.5	1.5			B1
L15653-01DUP	DUP	12/10/13 17:17			10.6	9.9	mg/Kg				6.8	20	
L15653-02AS	AS	12/10/13 17:20	WI121218-3	10	11.1	21.68	mg/Kg	105.8	75	125			

Organic Matter

USDA No.60 - Method 24

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG355454													
WG355454LCSS	LCSS	11/25/13 16:00	PCN32557	2		1.95	%	97.5					
WG355454PBS	PBS	11/25/13 19:04				U	%		-0.3	0.3			
L15653-01DUP	DUP	11/26/13 1:12			.8	.72	%				10.5	20	RA

pH, Saturated Paste

EPA 600/2-78-054, section 3.2.2

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG355542													
WG355542ICV	ICV	11/26/13 22:10	PCN42578	4		4	units	100	3.9	4.1			
L15653-01DUP	DUP	11/27/13 3:24			8.6	8.66	units				0.7	20	

MWH Americas Inc.

ACZ Project ID: L15653

Phosphorus, total (3050)					M6010B ICP									
ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual	
WG355673														
WG355673ICV	ICV	12/02/13 21:13	II131111-1	5		5.19	mg/L	103.8	90	110				
WG355673ICB	ICB	12/02/13 21:16				U	mg/L		-0.3	0.3				
WG355503PBS	PBS	12/02/13 21:28				U	mg/Kg		-30	30				
WG355503LCSS2	LCSS	12/02/13 21:38	PCN39902	842		704	mg/Kg		673.6	1010.4				
WG355503LCSSD2	LCSSD	12/02/13 21:41	PCN39902	842		704	mg/Kg		673.6	1010.4	0	20		
L15653-01MS	MS	12/02/13 21:47	II131119-3	101.0202	790	892	mg/Kg	101	75	125				
L15653-01MSD	MSD	12/02/13 21:50	II131119-3	101.0202	790	879	mg/Kg	88.1	75	125	1.47	20		
Potassium, total (3050)					M6010B ICP									
ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual	
WG355673														
WG355673ICV	ICV	12/02/13 21:13	II131111-1	20		19.64	mg/L	98.2	90	110				
WG355673ICB	ICB	12/02/13 21:16				U	mg/L		-0.9	0.9				
WG355503PBS	PBS	12/02/13 21:28				U	mg/Kg		-90	90				
WG355503LCSS1	LCSS	12/02/13 21:32	PCN42472	2600		2612	mg/Kg		1720	3470				
WG355503LCSSD1	LCSSD	12/02/13 21:35	PCN42472	2600		2872	mg/Kg		1720	3470	9.5	20		
L15653-01MS	MS	12/02/13 21:47	II131119-3	10094.48439	2410	13009	mg/Kg	105	75	125				
L15653-01MSD	MSD	12/02/13 21:50	II131119-3	10094.48439	2410	13059	mg/Kg	105.5	75	125	0.38	20		
Solids, Percent					CLPSOW390, PART F, D-98									
ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual	
WG355296														
WG355296PBS	PBS	11/21/13 19:00				U	%		99.9	100.1				
L15561-01DUP	DUP	11/21/13 22:09			23.9	24.39	%				2	20		

MWH Americas Inc.ACZ Project ID: **L15653**

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L15653-01	WG355925	Cation Exchange Capacity (CEC)	USDA No. 60 (19)	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG355912	Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	Q6	Sample was received above recommended temperature.
			ASA No.9 29-2.2.4 Combustion/IR	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
			ASA No.9 29-2.2.4 Combustion/IR	ZQ	Analyte was not evaluated in the laboratory control standard. Either the analyte is not included in the scope of the analytical method or a commercial standard containing the analyte is not available.
	WG355454	Organic Matter	USDA No.60 - Method 24	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG356206	Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate	B1	Target analyte detected in prep / method blank at or above the method reporting limit. See Case Narrative.
L15653-02	WG355925	Cation Exchange Capacity (CEC)	USDA No. 60 (19)	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG355912	Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	Q6	Sample was received above recommended temperature.
			ASA No.9 29-2.2.4 Combustion/IR	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
			ASA No.9 29-2.2.4 Combustion/IR	ZQ	Analyte was not evaluated in the laboratory control standard. Either the analyte is not included in the scope of the analytical method or a commercial standard containing the analyte is not available.
	WG355454	Organic Matter	USDA No.60 - Method 24	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG356206	Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate	B1	Target analyte detected in prep / method blank at or above the method reporting limit. See Case Narrative.
L15653-03	WG355925	Cation Exchange Capacity (CEC)	USDA No. 60 (19)	ZH	Serial Dilution exceeded the acceptance criteria. Matrix interference [physical or chemical] is suspected.
	WG355912	Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	Q6	Sample was received above recommended temperature.
			ASA No.9 29-2.2.4 Combustion/IR	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
			ASA No.9 29-2.2.4 Combustion/IR	ZQ	Analyte was not evaluated in the laboratory control standard. Either the analyte is not included in the scope of the analytical method or a commercial standard containing the analyte is not available.
	WG355454	Organic Matter	USDA No.60 - Method 24	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
	WG356206	Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate	B1	Target analyte detected in prep / method blank at or above the method reporting limit. See Case Narrative.

MWH Americas Inc.ACZ Project ID: **L15653****Metals Analysis****The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.**

Cation Exchange Capacity (CEC)	USDA No. 60 (19)
Phosphorus, total (3050)	M6010B ICP

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Cation Exchange Capacity (CEC)	USDA No. 60 (19)
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Soil Analysis**The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.**

Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR
Conductivity @25C	SM2510B
Organic Matter	USDA No.60 - Method 24
pH, Saturated Paste	EPA 600/2-78-054, section 3.2.2
Solids, Percent	CLPSOW390, PART F, D-98

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR
Conductivity @25C	SM2510B
Organic Matter	USDA No.60 - Method 24
pH, Saturated Paste	EPA 600/2-78-054, section 3.2.2
Solids, Percent	CLPSOW390, PART F, D-98

Wet Chemistry**The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.**

Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate
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The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate
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MWH Americas Inc.
10503311.020102 FML

ACZ Project ID: L15653
Date Received: 11/20/2013 10:28
Received By: mtb
Date Printed: 11/21/2013

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2) Is the Chain of Custody or other directive shipping papers present?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) Does this project require special handling procedures such as CLP protocol?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4) Are any samples NRC licensable material?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5) If samples are received past hold time, proceed with requested short hold time analyses?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Is the Chain of Custody complete and accurate?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Were any changes made to the Chain of Custody prior to ACZ receiving the samples?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Are all labels on containers and are they intact and legible?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10) Do the sample labels and Chain of Custody match for Sample ID, Date, and Time?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11) For preserved bottle types, was the pH checked and within limits?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12) Is there sufficient sample volume to perform all requested work?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13) Is the custody seal intact on all containers?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
14) Are samples that require zero headspace acceptable?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
15) Are all sample containers appropriate for analytical requirements?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16) Is there an Hg-1631 trip blank present?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
17) Is there a VOA trip blank present?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
18) Were all samples received within hold time?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp (°C)	Rad (µR/Hr)	Custody Seal Intact?
NA18751	14.8	13	N/A

Was ice present in the shipment container(s)?

No - Wet or gel ice was not present in the shipment container(s).

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Quote

Chad Tomlinson
MWH Americas Inc.
2890 E. Cottonwood Pkwy. Suite 300
Salt Lake City, UT 84121

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11/7/2013

Quote Number: FMC-AGRONOMIC

Matrix: Soil 3 Samples, One Time Analysis of Soil - FMC Agronomic Testing

Parameter	Method	Detection Limit	Cost/Sample
Metals Analysis			
Cation Exchange Capacity (CEC)	USDA No. 60 (19)	0.03 meq/100g	\$24.00
Phosphorus, total (3050)	M6010B ICP	10 mg/Kg	\$10.00
Potassium, total (3050)	M6010B ICP	30 mg/Kg	\$10.00
Misc.			
Electronic Data Deliverable			\$0.00
Quality Control Summary			\$0.00
Setup charge for ICP, total			\$16.00
Sample Preparation			
Air Dry at 34 Degrees C	USDA No. 1, 1972		\$8.00
Cation Exchange Capacity Extraction	USDA No. 60 (19)		\$0.00
Digestion - Hot Plate	M3050B ICP		\$16.00
Potassium Chloride Extraction	ASA No. 9 33-3.2.2		\$12.00
Saturated Paste Extraction	USDA No. 60 (2)		\$18.00
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2		\$12.00
Sieve-250 um (60 mesh)	ASA No.9, 15-4.2.2		\$12.00
Soil Analysis			
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Combustion/IR	0.1 %	\$38.00
Conductivity @25C	SM2510B	0.001 mmhos/cm	\$8.00
Organic Matter	USDA No.60 - Method 24	0.3 %	\$25.00
pH, Saturated Paste	EPA 600/2-78-054, section 3.2.2	0.1 units	\$8.00
Solids, Percent	CLPSOW390, PART F, D-98	0.1 %	\$8.00
Wet Chemistry			
Nitrogen, ammonia (KCL)	M350.1 - Automated Phenate	0.5 mg/Kg	\$11.00
Cost/Sample:			\$236.00

This quote is based on a Standard Turnaround Time (TAT) of approximately 21 days for soil and solid matrices (15 working days). TAT may vary with seasonal heavy workload. Please contact your PM if rush TAT is required. Rush TAT needs to be pre-approved prior to sample shipment to assure that due dates can be met. Pricing includes standard reporting formats and standard ACZ EDDs. All projects received are subject to a \$125.00 Minimum Charge. Please note that method detection limits are estimates and may be elevated depending on sample matrices that require dilution. Pricing includes coolers, soil jars or bags, labels, COCs and ice-packs if needed for your analysis, shipped to your site or office via UPS ground. Return shipping is the responsibility of the client. Please allow ample time for your bottles to arrive. Please note that soil preparation charges may fluctuate depending on the condition and volume of samples upon receipt. Wet samples may increase your TAT if air-drying is needed per your analysis.

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Quote

Chad Tomlinson
MWH Americas Inc.
2890 E. Cottonwood Pkwy. Suite 300
Salt Lake City, UT 84121

Page 2 of 2

11/7/2013

Quote Number: FMC-AGRONOMIC

CONTRACT DETAILS

Pricing includes shipment of all standard sample containers and related paperwork by UPS Ground Service. Please allow three to five days for delivery when ordering containers. ACZ must be notified prior to receiving samples of all special requests such as electronic data deliverables or special reporting requirements. The client will be charged for special sample containers or express shipping and additional charges may apply for non-standard requests.

This quotation is valid for six months from the bid date unless specified otherwise in the bid. All bids must be signed and returned to ACZ before the project(s) is received. The authorized signature represents acceptance of the pricing as well as the general terms and conditions of ACZ Laboratories, Inc. which may be downloaded from our web site at <http://www.acz.com/PDF/termsconditions.pdf>. Please note that MDL's in this quote may possibly increase due to sample matrix or samples with high TDS.

All orders that require shipping of coolers are subject to a minimum charge of \$200.00. Local orders without shipping are subject to a minimum charge of \$125.00. Samples may incur a \$11.00/sample disposal fee for any samples deemed to be hazardous.

ACZ Representative (Authorized signature and date)

Client Representative (Authorized signature and date)

APPENDIX F

Root Density Testing Report

Table of Soil and Root Weights for FMC Vegetation Survey Sample Locations from Nov. 12 and 13, 2013.

Sample	Soil Dry Weight with Roots (grams)	Root Dry Weight (grams)	Soil Dry Weight Without Roots (grams)	Grams of Roots per 100 grams of Soil
Grid #6—Location #1				
0-6 inches	807.45	0.15	807.30	0.019
6-12 inches	798.26	0.62	797.64	0.078
12-18 inches	786.17	0.02	786.15	0.003
Grid #6—Location #2				
0-6 inches	785.39	0.66	784.73	0.084
6-12 inches	792.90	0.15	792.75	0.019
12-18 inches	837.52	0.12	837.40	0.014
Grid #6—Location #3				
0-6 inches	744.77	0.24	744.53	0.032
6-12 inches	823.04	0.11	822.93	0.013
12-18 inches	804.68	0.04	804.64	0.005
Grid #7—Location #1				
0-6 inches	684.09	0.27	683.82	0.039
6-12 inches	813.18	0.16	813.02	0.020
12-18 inches	832.20	0.11	832.09	0.013
Grid #7—Location #2				
0-6 inches	829.41	0.30	829.11	0.036
6-12 inches	746.12	0.22	745.90	0.029
12-18 inches	844.83	0.18	844.65	0.021
Grid #7—Location #3				
0-6 inches	764.65	0.68	763.97	0.089
6-12 inches	781.57	0.19	781.38	0.024
12-18 inches	872.89	0.13	872.76	0.015
Grid #8—Location #1				
0-6 inches	769.74	0.79	768.95	0.102
6-12 inches	No sample	No sample	No sample	No sample
12-18 inches	806.99	0.16	806.83	0.020
18-24 inches	849.00	0.05	848.95	0.006
Grid #8—Location #2				
0-6 inches	762.51	0.58	761.93	0.076
6-12 inches	872.86	0.65	872.21	0.075
12-18 inches	801.06	0.10	800.96	0.013
18-24 inches	742.14	0.03	742.11	0.004
Grid #8—Location #3				
0-6 inches	797.74	0.38	797.36	0.048
6-12 inches	820.28	0.23	820.05	0.028
12-18 inches	839.66	0.11	839.55	0.013
Grid #13—Location #1				
0-6 inches	839.18	0.87	838.31	0.104
6-12 inches	699.50	0.25	699.25	0.036
12-18 inches	No sample	No sample	No sample	No sample

Sample	Soil Dry Weight with Roots (grams)	Root Dry Weight (grams)	Soil Dry Weight Without Roots (grams)	Grams of Roots per 100 grams of Soil
Grid #13—Location #2				
0-6 inches	793.79	0.51	793.28	0.064
6-12 inches	849.62	0.27	849.35	0.032
12-18 inches	No sample	No sample	No sample	No sample
Grid #13—Location #3				
0-6 inches	725.44	0.73	724.71	0.101
6-12 inches	961.91	0.33	961.58	0.034
12-18 inches	867.40	0.12	867.28	0.014
Grid #14—Location #1				
0-6 inches	814.19	0.71	813.48	0.087
6-12 inches	833.37	0.45	832.92	0.054
12-18 inches	834.95	0.13	834.82	0.016
Grid #14—Location #2				
0-6 inches	713.84	0.78	713.06	0.109
6-12 inches	898.16	0.46	897.70	0.051
12-18 inches	797.55	0.21	797.34	0.026
Grid #14—Location #3				
0-6 inches	807.28	0.43	806.85	0.053
6-12 inches	780.36	0.31	780.05	0.040
12-18 inches	805.32	0.15	805.17	0.019
Grid #15—Location #1				
0-6 inches	835.20	0.45	834.75	0.054
6-12 inches	772.33	0.14	772.19	0.018
12-18 inches	800.00	0.09	799.91	0.011
Grid #15—Location #2				
0-6 inches	729.58	0.56	729.02	0.077
6-12 inches	746.83	0.28	746.55	0.038
12-18 inches	848.75	0.07	848.68	0.008
Grid #15—Location #3				
0-6 inches	759.06	0.45	758.61	0.060
6-12 inches	930.29	0.21	930.08	0.023
12-18 inches	777.64	0.10	777.54	0.013
Grid #16—Location #1				
0-6 inches	822.27	0.57	821.70	0.069
6-12 inches	772.75	0.39	772.36	0.051
12-18 inches	831.66	0.13	831.53	0.016
Grid #16—Location #2				
0-6 inches	707.11	0.83	706.28	0.118
6-12 inches	844.97	0.37	844.60	0.044
12-18 inches	791.54	0.18	791.36	0.023

Sample	Soil Dry Weight with Roots (grams)	Root Dry Weight (grams)	Soil Dry Weight Without Roots (grams)	Grams of Roots per 100 grams of Soil
Grid #16—Location #3				
0-6 inches	743.60	0.62	742.98	0.083
6-12 inches	822.37	0.25	822.12	0.030
12-18 inches	773.69	0.12	773.57	0.016
Grid #17—Location #1				
0-6 inches	708.05	0.66	707.39	0.093
6-12 inches	778.98	0.19	778.79	0.024
12-18 inches	901.58	0.12	901.46	0.013
18-24 inches	810.23	0.04	810.19	0.005
Grid #17—Location #2				
0-6 inches	833.19	0.43	832.76	0.052
6-12 inches	811.03	0.16	810.87	0.020
12-18 inches	893.77	0.13	893.64	0.015
18-24 inches	877.61	0.02	877.59	0.002
Grid #17—Location #3				
0-6 inches	806.03	0.30	805.73	0.037
6-12 inches	871.40	0.27	871.13	0.031
12-18 inches	795.86	0.12	795.74	0.015
18-24 inches	796.35	0.05	796.30	0.006
Grid #18—Location #1				
0-6 inches	838.61	0.12	838.49	0.014
6-12 inches	854.60	0.15	854.45	0.018
12-18 inches	798.19	0.02	798.17	0.003
Grid #18—Location #2				
0-6 inches	776.15	0.53	775.62	0.068
6-12 inches	785.08	0.18	784.90	0.023
12-18 inches	838.00	0.11	837.89	0.013
Grid #18—Location #3				
0-6 inches	761.44	0.31	761.13	0.041
6-12 inches	731.57	0.16	731.41	0.022
12-18 inches	784.39	0.09	784.30	0.011

APPENDIX G

Stormwater Sewer Decontamination Water Laboratory Analysis Report and Video Survey

IAS EnviroChem

3314 Pole Line Rd. • Pocatello, ID 83201

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Kase Warbonnet Inc.**Mark R. Smith****1477 Thunderbolt****Pocatello, ID 83204****Date Submitted:** 11/14/2013**Date Reported:** 12/03/2013**Certificate of Analysis****Sample Description:** 111413-SDL**Lab Tracking #:** I311052-01**Sampling Date/Time:** 11/14/13 13:40

<u>Analyte</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>	<u>Analyzed</u>	<u>Analyst</u>
pH	7.6	pH Units	150.1	11/18/2013	MAD
TCLP Arsenic	< 0.05	mg/L	1311/6020A	11/29/2013	RP
TCLP Barium	0.07	mg/L	1311/6020A	11/29/2013	RP
TCLP Cadmium	< 0.05	mg/L	1311/6020A	11/29/2013	RP
TCLP Chromium	0.08	mg/L	1311/6020A	11/29/2013	RP
TCLP Lead	< 0.05	mg/L	1311/6020A	11/29/2013	RP
TCLP Mercury	< 0.01	mg/L	1311/6020A	11/29/2013	RP
TCLP Selenium	< 0.05	mg/L	1311/6020A	11/29/2013	RP
TCLP Silver	< 0.05	mg/L	1311/6020A	11/29/2013	RP

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Kase Warbonnet Inc.**Mark R. Smith****1477 Thunderbolt****Pocatello, ID 83204****Date Submitted:** 11/14/2013**Date Reported:** 12/03/2013**Certificate of Analysis****Sample Description:** 111413-SDS**Lab Tracking #:** I311052-02**Sampling Date/Time:** 11/14/13 13:55

<u>Analyte</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>	<u>Analyzed</u>	<u>Analyst</u>
TCLP Arsenic	< 0.05	mg/L	1311/6020A	11/29/2013	RP
TCLP Barium	0.32	mg/L	1311/6020A	11/29/2013	RP
TCLP Cadmium	0.06	mg/L	1311/6020A	11/29/2013	RP
TCLP Chromium	< 0.05	mg/L	1311/6020A	11/29/2013	RP
TCLP Lead	< 0.05	mg/L	1311/6020A	11/29/2013	RP
TCLP Mercury	< 0.01	mg/L	1311/6020A	11/29/2013	RP
TCLP Selenium	< 0.05	mg/L	1311/6020A	11/29/2013	RP
TCLP Silver	< 0.05	mg/L	1311/6020A	11/29/2013	RP

ND = Not Detected

All solids are reported on a dry weight basis unless otherwise noted.



G. Ryan Pattie
Laboratory Director

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Login Report

Customer Name: **Kase Warbonnet Inc.**
1477 Thunderbolt
Pocatello, ID 83204

Work Order #: **I311052**Contact Name: **Mark R. Smith**

Comment:

Sample Description: **111413-SDL**Sampling Date/Time: **11/14/13 13:40**Lab Tracking #: **I311052-01**Matrix: **Water**Date Received: **11/14/13 14:25**

Sample Notes:

<u>Test</u>	<u>Method</u>	<u>Due</u>
pH	150.1	11/28/13
TCLP Arsenic	1311/6020A	11/28/13
TCLP Barium	1311/6020A	11/28/13
TCLP Cadmium	1311/6020A	11/28/13
TCLP Chromium	1311/6020A	11/28/13
TCLP Lead	1311/6020A	11/28/13
TCLP Mercury	1311/6020A	11/28/13
TCLP Selenium	1311/6020A	11/28/13
TCLP Silver	1311/6020A	11/28/13

Sample Description: **111413-SDS**Sampling Date/Time: **11/14/13 13:55**Lab Tracking #: **I311052-02**Matrix: **Solid**Date Received: **11/14/13 14:25**

Sample Notes:

<u>Test</u>	<u>Method</u>	<u>Due</u>
TCLP Arsenic	1311/6020A	11/28/13
TCLP Barium	1311/6020A	11/28/13
TCLP Cadmium	1311/6020A	11/28/13
TCLP Chromium	1311/6020A	11/28/13
TCLP Lead	1311/6020A	11/28/13
TCLP Mercury	1311/6020A	11/28/13
TCLP Selenium	1311/6020A	11/28/13
TCLP Silver	1311/6020A	11/28/13

Sample Condition Record

Samples received in a cooler?	No
Samples received intact?	Yes
The temperature recorded?	19.8
Samples received with a COC?	Yes
Samples received within holding time?	Yes
Are all samples properly preserved?	Yes
Labels and chain agree?	Yes

DVD of Stormwater Sewer Piping Video Survey
(included in Hard Copy Reports Only)

APPENDIX H

ProUCL 5.0 Statistical Analysis

User Selected Options

From File	C:\Users\hartmanrj\Documents\FMC Projects\RD Work Plans\Data Gap WP\Field Data\Geotech data for
-----------	---

Full Precision	OFF
----------------	-----

Confidence Coefficient	95%
------------------------	-----

Coverage	90%
----------	-----

Different or Future K Values	1
------------------------------	---

Raw Statistics

Number of Valid Observations	10
------------------------------	----

Number of Distinct Observations	10
---------------------------------	----

Minimum	97.7
---------	------

Maximum	107.2
---------	-------

Second Largest	107
----------------	-----

Mean	104.2
------	-------

Geometric Mean	104.1
----------------	-------

First Quartile	103.8
----------------	-------

Median	104.6
--------	-------

Third Quartile	106.8
----------------	-------

SD	3.215
----	-------

Coefficient of Variation	0.0309
--------------------------	--------

Skewness	-1.211
----------	--------

Normal Distribution Test

Shapiro Wilk Test Statistic	0.843
-----------------------------	-------

5% Shapiro Wilk Critical Value	0.842
--------------------------------	-------

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

90% Percentile (z)	108.3
--------------------	-------

95% Percentile (z)	109.5
--------------------	-------

99% Percentile (z)	111.7
--------------------	-------

Tolerance Factor K	2.355
--------------------	-------

95% UTL with 90% Coverage	111.8
---------------------------	-------

95% UPL (t)	110.4
-------------	-------

Average K

Raw Statistics

Number of Valid Observations	6
------------------------------	---

Number of Distinct Observations	6
---------------------------------	---

Minimum	2.3000E-5
---------	-----------

Maximum	1.4000E-4
---------	-----------

Second Largest	7.8000E-5
----------------	-----------

Mean	6.5667E-5
------	-----------

Geometric Mean	5.5682E-5
----------------	-----------

2014-03-14 FMC Data Gap Report for the FMC OU - Highlighted Rev.pdf	First Quartile		3.9250E-5						
	Median		6.0000E-5						
	Third Quartile		7.4000E-5						
	SD		4.1563E-5						
	Coefficient of Variation		N/A						
	Skewness		1.252						
	Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!								
	It is suggested to collect at least 8 to 10 observations using these statistical methods!								
	If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.								
Normal Distribution Test									
Shapiro Wilk Test Statistic			0.901						
5% Shapiro Wilk Critical Value			0.788						
Data appear Normal at 5% Significance Level									
Background Statistics Assuming Normal Distribution									
90% Percentile (z)			1.1893E-4						
95% Percentile (z)			1.3403E-4						
99% Percentile (z)			1.6236E-4						
Tolerance Factor K			3.006						
95% UTL with 90% Coverage			1.9060E-4						
95% UPL (t)			1.5613E-4						
In-situ Moisture									
Raw Statistics									
Number of Valid Observations			9						
Number of Distinct Observations			9						
Minimum			4.8						
Maximum			15.5						
Second Largest			15.1						
Mean			8.733						
Geometric Mean			7.987						
First Quartile			5.9						
Median			8.4						
Third Quartile			9.4						
SD			4.071						
Coefficient of Variation			0.466						
Skewness			0.972						
Normal Distribution Test									
Shapiro Wilk Test Statistic			0.839						
5% Shapiro Wilk Critical Value			0.829						
Data appear Normal at 5% Significance Level									
Background Statistics Assuming Normal Distribution									

Optimum Moisture

[illegible]

[illegible]

2014-03-14 FMC Data Gap Report for the FMC OJ J - Highlighted Rev.pdf											
	Tolerance Factor K				2.454						
	95% UTL with 90% Coverage				19.62						
	95% UPL (t)				19.11						

2014-03-14 FMC Data Gap Report the FMC OU - Highlighted Rev.pdf																		
				Normal Background Statistics for Full Data Sets														
	User Selected Options																	
	From File			C:\Users\hartmanrj\Documents\FMC Projects\RD Work Plans\Data Gap WP\Field Data\Root density data														
	Full Precision			OFF														
	Confidence Coefficient			95%														
	Coverage			90%														
	Different or Future K Values			1														
	0.0 to 6 inches																	
Raw Statistics																		
Number of Valid Observations			27															
Number of Distinct Observations			27															
Minimum			0.014															
Maximum			0.118															
Second Largest			0.109															
Mean			0.067															
Geometric Mean			0.0598															
First Quartile			0.0445															
Median			0.068															
Third Quartile			0.088															
SD			0.0285															
Coefficient of Variation			0.425															
Skewness			-0.0498															
Normal Distribution Test																		
Shapiro Wilk Test Statistic			0.973															
5% Shapiro Wilk Critical Value			0.923															
Data appear Normal at 5% Significance Level																		
Background Statistics Assuming Normal Distribution																		
90% Percentile (z)			0.103															
95% Percentile (z)			0.114															
99% Percentile (z)			0.133															
Tolerance Factor K			1.811															
95% UTL with 90% Coverage			0.119															
95% UPL (t)			0.116															
12 to 18 inches																		
Raw Statistics																		
Number of Valid Observations			25															
Number of Distinct Observations			13															
Minimum			0.003															
Maximum			0.026															
Second Largest			0.023															
Mean			0.014															
Geometric Mean			0.0125															

[illegible]

0.4 to 12 inches

Nonparametric Background Statistics								
95% Chebyshev UPL		0.108						
95% BCA Bootstrap UTL with 90% Coverage		0.075						
95% Bootstrap (%) UTL with 90% Coverage		0.0765						
Raw Statistics								
Number of Valid Observations		53						
Number of Distinct Observations		44						
Minimum		0.013						
Maximum		0.118						
Second Largest		0.109						
Mean		0.0506						
Geometric Mean		0.0429						
First Quartile		0.028						
Median		0.041						
Third Quartile		0.075						
SD		0.0287						
Gamma Distribution Test								
k hat (MLE)		3.169						
k star (bias corrected MLE)		3.002						
Theta Hat (MLE)		0.016						
Theta star (bias corrected MLE)		0.0169						
nu hat (MLE)		335.9						
nu star (based upon bias corrected estimates)		318.2						
MLE Mean (based upon bias corrected estimates)		0.0506						
MLE Sd (based upon bias corrected estimates)		0.0292						
95% Percentile of Chisquare (2k)		12.6						
A-D Test Statistic		0.602						
5% A-D Critical Value		0.757						
K-S Test Statistic		0.088						
5% K-S Critical Value		0.123						
Data appear Gamma Distributed at 5% Significance Level								
Background Statistics Assuming Gamma Distribution								
90% Percentile		0.0898						
95% Percentile		0.106						
99% Percentile		0.142						
95% Wilson Hilferty (WH) Approx. Gamma UPL		0.107						
95% Hawkins Wixley (HW) Approx. Gamma UPL		0.109						
Tolerance Factor K		1.628						
95% Wilson Hilferty (WH) Approx. Gamma UTL with 90% Coverage		0.104						
95% Hawkins Wixley (HW) Approx. Gamma UTL with 90% Coverage		0.106						
Nonparametric Background Statistics								
95% Chebyshev UPL		0.177						

[illegible]

**FMC Responses to EPA Comments, dated and received February 20, 2014, on the
Remedial Design (RD) Data Gap Report for the FMC Operable Unit (OU), submitted
January 28, 2014**

March 14, 2014

I. General Comment

1. Field activities and results of the investigation were detailed in the Data Gap Report. However, little discussion was provided to indicate how the new soil data will affect ET cover and gamma cap designs (i.e., acceptability of the borrow soil for its intended purpose). It is expected that such details will be provided in the draft design documents for this project and will be reviewed at that time. No change is needed on this document.

FMC Response: The purpose of the Data Gap Report was to summarize the field investigation and results of laboratory testing. The data presented in the Data Gap Report is currently being incorporated into the design of the ET covers. Given that the predominant soil type encountered was silt loess, which exhibits both high moisture capacity and low plasticity, there is nothing to suggest that the WUA is not an acceptable borrow source for cover material.

II. Specific Comments

Section 1.1, Regulatory Background, page 1-2

1. The last sentence in this section should be revised to include the date on which EPA approved the DGWP. In addition, the October 2013 version of the DGWP should be listed in the references section.

FMC Response: The Data Gap Report has been revised to address this comment.

Section 1.4, Document Organization, page 1-2

2. The first sentence in this section should be revised to refer to the Data Gap Report instead of the DGWP.

FMC Response:

The Data Gap Report has been revised to address this comment.

Table 2-1, Summary of WUA Soil Investigation, pages 2-1 and 2-2

3. The DGWP called for collection of grab samples of silt at one foot intervals to a depth of 10 feet below ground surface (bgs) in each test pit. However, in several of the test pits, gravel was encountered at depths shallower than 10 feet bgs. Accordingly, the sampling depths indicated in Table 2-1 should be revised to indicate the actual extent of grab sampling conducted (i.e., 4 feet bgs in test pit TP003, 7 feet bgs in test pit TP009, and 6 feet bgs in test pit TP010).
-

FMC Response: Table 3.1 of the Data Gap Work Plan (MWH, 2013) states that disturbed samples will be collected to a total depth of “10 feet or until gravels are contacted”. Due to the size of the excavator used at the site, the test pits were able to be excavated to deeper depths up to 20.5 feet. Although samples were not generally collected at depths below 10 feet, the test pits were excavated deeper to provide visual observations and logging at deeper depths. Based on visual evidence of the test pit, it is clear that the soil characteristics of silt are uniform throughout the soil profile until the underlying gravels are contacted. Table 2-1 has been revised to add an additional column titled, “Maximum Depth of Grab Sample.”

4. Expand the footnote to this table to indicate that the qualifier NC applies to test pits in which gravels were not contacted before the maximum depth of the excavator was reached.

FMC Response: The footnote has been revised to address the comment.

Section 2.1.1, Test Pits, page 2-24.

5. This section should be expanded to discuss the observed variability in depth to gravel within the WUA. Gravel was not encountered at all in more than half of the test pits (TP002, TP004, TP005, TP006, TP007, and TP008). Conversely, gravel was encountered at relatively shallow depths (between 4 and 7.5 feet bgs) in three of the pits (TP003, TP009, and TP010). As noted in the test pit logs (page 56 of the electronic file), this area of shallow gravel appears to cut from east to west across the center of the WUA study area. Such detail is important because it will affect the available volume of borrow soil in this location.

FMC Response: Comment noted. Figure 4-1, showing the cut isocontour map takes into consideration this east-west trending gravel lense; and therefore, does not factor this portion of the WUA into the volume calculations for available cover soil. Section 2.1.1 has been revised to further explain the presence and extent of the gravels. (See also FMC Response to Comment 17 below.)

6. For consistency with Table 2-1, correct this section to note that test pits were excavated to depths ranging from 4 to 20.5 feet below ground surface (bgs).

FMC Response: Section 2.1.1 has been revised accordingly.

Section 2.1.2, Soil Borings, page 2-3

7. As indicated in the DGWP, undisturbed silt samples were to be collected from five soil borings at depths between 2-3 and 6-8 feet below ground surface (bgs). However, Table 2-1 indicates that the only soil sample from boring SB003 was collected from 0-2 feet bgs. A review of the associated boring log in Appendix C shows that silt was encountered only in the uppermost two feet of this boring. Consequently, no undisturbed soil samples could be collected from the pre-determined depths of 2-3 and 6-8 feet bgs. While this deviation from the DGWP appears to be acceptable, an explanation for it should be provided in the text of the Data Gap Report.

FMC Response: Section 2.1.2 has been revised to indicate that an undisturbed sample of silt was collected from 0 to 2 feet bgs in SB003 due to the presence of gravels below 2 feet at that boring location. In addition, a disturbed sample of gravel was collected from the drilling augers from 2 to 15 feet SB003. This sample was analyzed for hydraulic conductivity for the purposes of designing the potential infiltration basin as part of Groundwater Option B. Table 2-1 has been revised to include this sample, text has been added to Section 2.1.2 to describe the collection of this sample and the hydraulic conductivity result has been added to Table 3.2.

8. As shown in Table 2-1, a silt samples from the 12-14 feet bgs interval was collected from boring SB007. The text indicates that this sample was collected to provide geotechnical information on deeper silts at the WUA. It is unclear whether a single sample will adequately represent properties of deeper silt across the WUA. Given the fact that deep silt was found in numerous test pits and borings across the WUA, it is likely that deep silt will be incorporated into the planned ET and gamma caps. Section 4 of the report should compare shallow and deep silt results (as shown on Table 3-1), and clarify whether any significant differences were evident that may impact design or construction of the ET and gamma caps. If significant differences are identified, additional samples should be collected to determine the usability of deeper silt.

FMC Response: As described in Section 4 of the Data Gap Report, ProUCL statistical analysis was performed on laboratory data from both in-situ and ex-situ samples for maximum dry density and moisture content. Based on the analysis, the data distributions are normal suggesting a uniform soil type. In addition, a review of all particle size distribution (PSD) plots and Atterberg Limits Tests for disturbed samples of the silt further confirms a uniform soil type. It should be noted that index properties such as PSDs and Atterburg Limits are a key indicator of soil type. Additionally, the manner in which these silts were deposited, aeolian, further suggests that the physical properties of the soil with depth will remain consistent. Therefore, further sampling of silts at deeper depths is not warranted. Additional text has been added to Section 4.1 that describes the uniformity of the silt with depth.

9. According to the Table 3.1 of the DGWP, gravel samples were to be collected from the five soil borings at a depth approximately 10 feet beneath the gravel horizon. However, it does not appear that gravel samples were collected from the soil borings for permeability analysis. In fact, Section 2.1.2 of the report indicates that the only one gravel sample collected during this investigation was taken from test pit TP003, and the associated log in Appendix B (page 46 of the electronic file) suggests that the samples was collected from the top of the gravel horizon (i.e., at 4feet bgs, rather than 14 feet bgs). This deviation from the approved DGWP suggests that inadequate gravel data has been obtained. The text of the report should be revised to: (1) document these deviations in the sampling program; (2) discuss whether the single, shallow gravel sample is representative of gravel across the WUA; and (3) explain why additional gravel samples are not needed to meet RD information needs. If sufficient justification cannot be provided, additional gravel samples are recommended.

FMC Response: While preparing the Data Gap Work Plan, the depths of gravels were believed to be much shallower, on the order of ± 10 feet. However, during the test pitting, the depths of gravel were shown to be generally much deeper than 10 feet throughout the site, with the exception of the shallow east-west gravel lense. The main purpose of the gravel sampling was to determine the hydraulic conductivity of the gravels for the purpose of sizing potential infiltration basins for treated groundwater for groundwater remedy water management option B. Given that the depth of excavation required to obtain the volume of capping soil will in general be much shallower than the underlying gravels, it was determined that the controlling factor in the infiltration basins will be the in-situ hydraulic conductivity of the silts. Therefore, an undisturbed sample of the silts at deeper depth, 12-14 feet bgs, was collected from SB0007 to provide data for this purpose. Further, the gravels that were contacted appeared to be very uniform in terms of shape and size suggesting the hydraulic conductivity of these gravels will be fairly uniform. Therefore, no additional sampling is required at deeper depths for the gravels. Additional text has been added to Section 2.1.2 that incorporates this response.

10. The first sentence in this section should be corrected to note that the five soil borings advanced during this investigation were numbered SB003 through SB008, with the exception of SB005. No soil boring was conducted in the vicinity of test pit TP005.

FMC Response: The text has been revised to address the comment.

Section 2.2.1, Stormwater Sewer Survey Background and Objectives, page 2-3

11. The first paragraph in this section indicates that the selected remedy for RA-A calls for covering the area (and underground storm sewer piping) with a gamma cap. The second paragraph indicates that any segments of the storm sewer pipe that cannot be cleaned within RA-B will be plugged with concrete and covered by an ET cap. Expand this section to identify remedial action objectives (RAOs) for the storm sewer, and confirm that both types of caps will satisfactorily achieve those RAOs.

FMC Response: The relevant RAOs for the underground storm sewer piping in RA-A (and RA-B and RA-K) as taken from Table 4-2 of the Supplemental Feasibility Study Report for the FMC Plant OU – July 2010 (SFS Report) are:

1. Prevent external exposure to radionuclides in soils at levels that pose estimated excess risk greater than 1×10^{-4} , or site-specific background levels where that is not practical.
2. Prevent ingestion of soils containing COCs at levels that pose estimated excess risks above 1×10^{-4} , a non-cancer risk HQ of 1, or site-specific background levels where that is not practical.
3. Reduce the release and migration of COCs to the groundwater from facility sources that may result in concentrations in groundwater exceeding risk-based concentration (RBCs) or chemical specific Applicable or Relevant and Appropriate Requirements (ARARs), specifically Maximum Contaminant Levels (MCLs).

In addition, the following RAO was developed (as presented in Section 7.1.1 of the SFS Report) to address elemental phosphorus (P4) in subsurface soils and underground piping as a principal threat source material (PTSM):

- Prevent direct exposure to P4 under conditions that may spontaneously combust, posing a fire hazard, or resultant air emissions that represent a significant risk to human health and the environment.

Underground storm sewer piping that is successfully cleaned in-place will no longer present a threat to human health and/or the environment as all COCs potentially associated with the storm sewer piping (i.e., P4, radionuclides, metals, and leachable metals posing a threat to groundwater) will have been removed and appropriately disposed. Therefore, cleaned underground storm sewer piping by itself meets all of the above-listed RAOs. While this underground storm sewer piping resides in RA-A, which will be capped with a gamma cap as prescribed in the IRODA, the remedial action for the underground storm sewer piping is independent of the requirement for placement of the gamma cap in RA-A.

While we generally understand that the underground storm sewer piping can be cleaned with readily available technology, a contingency was included in Section 2.2.1 of the Data Gap Report, in the event sections of the piping could not be cleaned. In that event, the ET cap placed over RA-B could be extended over the un-cleaned sections of underground piping. As stated in the SFS Report and accepted in the IRODA, placement of a properly designed ET cap over underground piping would meet all of the above listed RAOs, even with the presumption that radionuclides, metals, and/or P4 remain within the un-cleaned sections of the underground storm sewer piping.

Regardless, at any level of success of cleaning of the underground storm sewer piping in RA-A, the underground piping would be plugged at the boundaries of RA-A with RA-B and RA-K to eliminate a conduit for water moving between the different capped areas.

Section 2.2.1 has been modified to clarify this achievement of the RAOs.

Section 2.2.2, Video Survey Description, pages 2-4 and 2-5

12. This section summarizes results of the storm sewer video survey which, as shown on Figure 2-2, extended across RA-A, RA-B, and RA-K. Each segment in the figure appears to have been addressed except for the one between Area Inlets 1 and 3. Confirm the status of surveying over this area and modify the Data Gap Report accordingly.

FMC Response: The Data Gap report has been revised to better clarify that while historical plant drawings indicate that the piping segment from Area Inlet #1 to Area Inlet #3 exists, visual investigation of the vault at Area Inlet #1 did not reveal the presence of a pipe entering from the south – only a pipe running towards the north to the East Discharge. Similarly, visual investigation of the vault at Area Inlet #3 only revealed pipes connected on the south side (from Manhole #1) and west side (toward Area Inlet #4); no pipe leaving to the north towards Area Inlet #1 was present. Whether the

historical drawing was incorrect or had not been updated to reflect later removal of the pipe segment cannot be determined; regardless, there is no observable evidence that a segment of piping is present between Area Inlet #3 and Area Inlet #1. Therefore, this segment was not present to survey. The figure has been revised to indicate this piping segment is not present and a bullet has been added at the end of Section 2.2.2 that incorporates this response into the text.

Section 3.1.2, Hydrological Testing, page 3-1

13. According to Table 3.2 of the DGWP, disturbed soil samples from every other test pit were to be sampled for saturated hydraulic conductivity (ASTM D5084) at 85 and 90% of the maximum dry density (MDD) level. Thus, ten samples would undergo conductivity testing. Ten water characteristic curve tests (ASTM D6836) – two tests on every other test pit sample – were also slated for completion. However, Table 3-2 of the report suggests that only five test pit samples were subjected to these analyses. A review of Appendix D indicates that all five of the test pit samples were analyzed at 85% MDD, and that no data are available for conductivity at 90% MDD. These deviations from the work plan should be noted in the text, along with an explanation as to why these changes should not be considered lingering data gaps for the investigation.

FMC Response: The DGWP specified that Soil Water Characteristic Curve Testing would be performed on disturbed samples remolded to both 85 and 90% of MDD. However, Water Characteristic Curve Testing was performed only on disturbed samples remolded to 85% MDD. The deviation was mainly due to the fact that the construction specifications for the cover soil (silt from the WUA) would target an in-place density of 85% MDD \pm 3%. This specification has been chosen to limit the in-place density to below 90% MDD. Therefore, Water Characteristic Curve Testing at 90% MDD was not warranted. Section 3.1.2 has been revised to describe and justify this deviation from the Work Plan.

Section 3.2, Root Density Testing, pages 3-4 through 3-6

14. Appendix F shows that root density testing was performed on depth-specific samples collected from three locations in each of nine grids across the existing vegetable trial plot. Expand Table 3.4 of the report to also show root density results for Grid 16, Location 3; all three locations within Grid 17, and all three locations within Grid 18 (provided on page 178 of the electronic file). In addition, correct the last sentence on page 3-6 to refer to the 6- to 12-inch interval at Grid 8, which was not analyzed because it was compromised during shipping. Finally, describe the incident in which this sample was compromised and detail what was done to ensure that none of the other samples had been similarly affected.

FMC Response: Table 3.4 has been revised to list the additional samples from Grids 16, 17, and 18. The last paragraph of Section 3.2 has been revised to correct the reference to Grid 8 and explain that the sample bag was reported as torn when received at the laboratory and was evidently damaged during shipment.

Section 4.1, Geotechnical Recommendations, page 4-1

15. This section should be expanded to discuss results pertaining to the susceptibility of WUA soils to erosion and desiccation cracking, as determined during the data gap investigation. The discussion should also indicate whether the majority of WUA soils are sufficiently nondispersive for purposes of cap construction. Any limitations on use of WUA borrow soil identified as dispersive (i.e., rating a 3 via the Crumb Test) should also be specified.

FMC Response: Additional text related to the erosion and desiccation potential of the WUA soils has been added to Section 4.1. Atterberg limits and dispersive testing was performed on the majority of disturbed samples to assess the potential for desiccation cracking and erosion of the silts. Based on the Atterberg limits testing, the plasticity index (PI), ranged between 1 and 14. These results indicate that the soils have very low-plasticity and therefore are not susceptible to desiccation cracking associated with volumetric changes (shrinkage) induced by moisture fluctuations. The results of the dispersion testing both (Crumb and double hydrometer testing) indicate that the soils are generally non-dispersive to moderately dispersive based on Crumb test results characterizing the majority of samples being between a Grade 1(non-dispersive) and 2 (Intermediate) and double hydrometer testing ranging between 18.6 and 44.3-percent dispersion. Therefore, based on these results, there is nothing to preclude the WUA soils being used as capping soil.

Section 4.3, Root Density Recommendations, page 4-2

16. Statistical analyses presented in Appendix H indicated depth-specific root density mean values (expressed as grams of dry root material per 100 grams of soil) of:
- 0.067 grams in the 0-6 inch sampling interval;
 - 0.0337 grams in the 6-12 inch sampling interval; and
 - 0.014 grams in the 12-18 inch sampling interval.

A statistical evaluation of all 53 soil samples collected from the 0-6 and 6-12 inch intervals yielded a mean root density value of 0.051 grams. As noted in Section 4.3, this value was selected as the design root density value to be used in RD development. However, it is unclear why results from the 12-18 inch sampling interval were not included in this analysis. If root density below the uppermost foot of soil is not considered an important factor for cap design, it is unclear why soil samples were even collected from the deeper intervals for root density analysis. Expand the text to provide justification for these omissions and to explain how use of the selected design value will affect establishment of an adequate vegetative cover layer on the ET and gamma caps.

FMC Response: Samples collected below 6-12 inches were not factored into the statistical analysis because the cover design assumes the bulk of root density is within the upper 12-inches. This is a conservative assumption given that there were roots present below 12-inches. However, due to the sparser aerial distribution of the 12-18-inch soil thickness at the re-vegetation test area, these data were not included in the statistical analysis. No changes to the text are warranted.

Section 4.5, Borrow Source Availability, page 4-2

17. This section states that approximately 2.4 million cubic yards of silt are available at the WUA for use in the ET and gamma covers. However, this estimate is unsupported by mathematical calculations or software output. Instead, this estimate was reportedly based on Figure 4-1, an isocontour map showing the depth of silt in the WUA. However, this figure is confusing, with contour lines that are unlabeled and difficult to translate into depths. It is possible that a different visual approach (e.g., using shades of color to represent silt thickness) would facilitate interpretation of Figure 4-1. Moreover, it does not appear that the figure accounted for soils deemed unusable due to dispersivity or other considerations. Revise the figure to provide for better interpretation, and provide calculations demonstrating how the figure was determined.

FMC Response: Figure 4-1 has been revised to change it from an isocontour to an isopach drawing to show color shading associated with depths of excavation. Note that the borrow availability assessment excludes from consideration the area in the vicinity of the shallow gravels. Additionally, there is no evidence to preclude any silt soils from being used as borrow material based on dispersion or desiccation potential. No changes to the text are warranted.

Table 4.3, Summary of Stormwater Sewer Piping Video Survey, page 4-3

18. After adding in sediment and other solids present between Area Inlets 1 and 3 (as discussed in Specific Comment 12 above), this table should be identified as a conservative estimate of solids to be removed from the storm sewer in areas RA-A, RAB, and RA-K. Relatively clear areas noted in Section 2.2.2 of the report (i.e., the first 40 feet in the segment from the east discharge pipe toward Area Inlet 1 and the first 55 feet in the segment from Manhole 1 to Area Inlet 3) do not appear to have been subtracted out of the volume calculations in this table.

FMC Response: As stated in response to Comment 12 above, the piping segment between Area Inlets 1 and 3 has been determined to no longer be present based on visual investigations in the vaults at both Area Inlet 1 and Area Inlet 3. Therefore, this segment was not included in Table 4.3. Also, column 6 (*Percent full of Sediment*) is an estimated average over the total length of the piping segment. A footnote has been added to Table 4.3 to indicate that the calculated “maximum” sediment volumes are a conservative estimate for waste management planning purposes.